MP. BUR.
ENTOM

State of Connecticut

The Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

Bulletin 247

BEING THE

TWENTY-SECOND REPORT OF THE STATE ENTOMOLOGIST FOR 1922

W. E. BRITTON, PH.D.

TWENTY-SECOND REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1922

(Being Bulletin 247, Connecticut Agricultural Experiment Station)

BY
W. E. BRITTON, PH.D.
State Entomologist

NEW HAVEN, CONN.
1923

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

February, 1923

BOARD OF CONTROL.

His Excellency, Charles A. Templeton, *ex-officio, President.*
James H. Webb, *Vice President* ..... Hamden
George A. Hopson, *Secretary* ..... Mt. Carmel
E. H. Jenkins, *Director and Treasurer* ..... New Haven
Joseph W. Alsop ..... Avon
Charles R. Treat ..... Orange
Elijah Rogers ..... Southington
Edward C. Schneider ..... Middletown

STAFF.

Administration.
E. H. JENKINS, PH.D., *Director and Treasurer.*
W. L. SLATE, B.Sc., *Vice Director.*
MISS L. M. BRAUTLECHT, *Librarian and Bookkeeper.*
MISS J. V. BERGER, *Stenographer and Bookkeeper.*
WILLIAM VEITCH, *In charge of Buildings and Grounds.*

Chemistry:
Analytical Laboratory.
E. MONROE BAILEY, PH.D., *Chemist in Charge.*
R. E. ANDREW, M.A.
C. E. SHEPARD,
OWEN L. NOLAN,
HARRY J. FISHER, A.B.
} *Assistant Chemists.*
FRANK SHELDON, *Laboratory Assistant.*
V. L. CHURCHILL, *Sampling Agent.*
MRS. B. P. STORRS, *Clerk.*

Biochemical Laboratory.
T. B. OSBORNE, PH.D., D.Sc., *Chemist in Charge.*

Botany.
G. P. CLINTON, Sc.D., *Botanist in Charge.*
E. M. STODDARD, B. S., *Pomologist.*
MISS FLORENCE A. MCCORMICK, PH.D., *Pathologist.*
G. E. GRAHAM, *General Assistant.*
MRS. W. W. KELSEY, *Secretary.*

Entomology.
W. E. BRITTON, PH.D., *Entomologist in Charge; State Entomologist.*
B. H. WALDEN, B.AGR., M. P. ZAPPE, B.S.,
PHILIP GARMAN, PH.D.
} *Assistant Entomologists.*
JOHN T. ASHWORTH, *Deputy in Charge of Gipsy Moth Work.*
SAMUEL T. SEALY, *Deputy in Charge of Mosquito Control.*
MISS GLADYS M. FINLEY, *Stenographer.*

Forestry.
WALTER O. FILLEY, *Forester in Charge.*
A. E. MOSS, M. F., *Assistant.*
H. W. HICOCK, M.F., *Assistant.*
MISS PAULINE A. MERCHANT, *Stenographer.*

Plant Breeding.
DONALD F. JONES, S.D., *Plant Breeder.*
P. C. MANGELSDORF, B.S., *Assistant.*

Tobacco Sub-Station at Windsor.
G. H. CHAPMAN, PH.D., *in Charge.*

CONTENTS

	PAGE
Twenty-second Report of the State Entomologist	269
Report of Receipts and Expenditures	270
Summary of Inspection and Office Work	270
Publications of Entomological Department	271
Department Staff and Work	272
Entomological Features of 1922	274
Fruit Insects	275
Vegetable Insects	276
Shade Tree and Forest Insects	277
Miscellaneous Insects	278
Inspection of Nurseries	279
Pests	279
Nursery Firms Receiving Certificates in 1922	280
Inspection of Imported Nursery Stock	282
Pests Found on Imported Nursery Stock	284
Inspection of Apiaries	284
Summary	289
Report of Work in Suppressing the Gipsy and Brown-tail Moths	290
Extensive Wind-spread	290
Methods of Work	291
Scouting	291
Marking Trees	292
Spraying and Banding Trees	293
Labor Conditions	293
Equipment	294
Details of Work in Each Town	294
Statistics of Infestations	310
Summary of Infestations	313
Towns in the Infested Area Which Were Not Scouted	313
Parasites	313
The Gipsy Moth Quarantine	317
Financial Statement	321
Cost of Moth Suppression Work	321
Increased Appropriation Needed	322
Infestations in Other States	323
Future Outlook	324
Recommendations	326
Mosquito Control Work, 1922	326
Tests of Sprays to Control the San José Scale	329
Tests of Paradichlorobenzene as a Remedy for the Peach Borer	331
Cabbage Root Maggot Experiments	332
Work with the European Red Mite in 1922	333
The Occurrence of Several New Spider Mites in Connecticut	338
Notes on the Life History of the Spruce Mite	340
Does the Corn Ear Worm Live Over Winter in Connecticut?	343
Notes on the Egg Stage of the Euonymus Scale	344
An Asiatic Beetle in Connecticut	346
Nicotine Dust as a Control for the Turnip Aphid	346
The Rhododendron Borer	347
Life History	349
Natural Enemies	349
Descriptions	350
Control	351

PAGE

The Maple Borer 351
Character of Injury 352
Life History and Habits 353
Description 354
Control Measures 354
The Maple Sesian 355
Life History and Habits 356
Description 356
Natural Enemies 357
Control 357
The Spruce Gall Aphid 357
Life History and Habits 358
Control Measures 359
The Bronze Birch Borer 359
Character of Injury 360
Life History and Habits 360
Description 361
Control Measures 361
Control of Ant Invasions 361
The European Corn Borer 367
Miscellaneous Insect Notes 369
Chinch Bugs Injuring Lawn 369
The Sour Gum Leaf-miner 369
The Blue Elm Beetle 369
Scolytid Beetles in Pine Trees 369
Leaf-miner in Cultivated Sorrel 369
Beetles Boring in the Timbers of an Old House 370
A Rare and Curious Horn Worm 370
Galls on European Willows 370
The Cottony Cushion Scale in a Connecticut Greenhouse 371
Maggots Appearing in Factory 371
A Borer in Rose Stems 372
Rose Midge in Connecticut 372
Cut-worms Injuring Strawberries 372
Larvae Feeding upon Pansies 373
A New House Fly in Connecticut 373
The Hemlock Web-worm 374
Rose Chafers in Vineyard 374
Cut-worms Attacking Raspberries and Asparagus 375
Cabbage Worms Controlled by Sulphur-Lead-Arsenate Dust 376
Springtails Injuring Vegetable Seedlings 376
Clothes Moths 377
Note Regarding Authorship 377
Illustrations 377
Index 379

BULLETIN 247

TWENTY-SECOND REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I transmit, herewith, my twenty-second annual report as State Entomologist of Connecticut. The financial statements cover the State fiscal year ending June 30, 1922, but in other respects this report deals with the activities of the department for the calendar year of 1922. One of its features is the remarkable wind-spread of the gipsy moth which we thought was well under control until the beginning of the year 1922. All regulatory matters, such as inspection of nurseries, imported nursery stock, and apiaries, mosquito elimination and gipsy moth control, are described in detail. Two important papers describing work done in part by this department have been published, as follows: Results of Dusting versus Spraying in Connecticut Apple and Peach Orchards in 1922, Bulletin 245: The Apple and Thorn Skeletonizer, Bulletin 246. These papers, though mentioned herein are not included as a part of this report. Other papers describe experiments of the staff on controlling cabbage root maggot, paradichlorobenzene for peach borers, dusting cabbages and turnips, European red mite, spruce mite, corn ear worm, San José scale, and observations and studies on the rhododendron borer, maple borer, maple sesian, bronze bich borer, European corn borer, ant invasions and many notes on miscellaneous insects, all of which vitally or indirectly concern the welfare or interest of the people.

Respectfully submitted,

W. E. Britton, *State Entomologist.*

Report of Receipts and Expenditures of the State Entomologist

From July 1, 1921, to June 30, 1922

RECEIPTS

From E. H. Jenkins, Treasurer	$12,500.00	
State Comptroller, Gipsy moth account	272.44	
Old automobile, exchanged	125.00	
Interest on Bank Deposits	24.21	
Various sources (Automobile Mileage)	54.10	
		$12,975.75

EXPENDITURES

For Salaries and Wages	$8,352.42	
Printing and Illustrations	28.15	
Postage	63.22	
Stationery	64.78	
Furniture and Fixtures	91.28	
Library (Books and Periodicals)	55.50	
" (Binding)	34.45	
Laboratory Supplies	74.52	
Spraying Supplies	334.81	
Machinery, Tools and Supplies	44.40	
Scientific Apparatus	32.83	
Express, Freight and Cartage	113.04	
Automobiles, New	1,644.55	
" Insurance	84.72	
" Supplies and Equipment	149.16	
" Repairs	140.21	
" Gasoline	191.85	
" Oil	11.71	
Traveling Expenses	374.62	
Balance, Cash on Hand	1,089.53	
		$12,975.75

Memorandum:—This account has been audited by the State Auditors of Public Accounts. The item of $272.44 received from the State Comptroller is really a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in the work of inspecting imported nursery stock.

SUMMARY OF INSPECTION AND OFFICE WORK

266 samples of insects received for identification.
106 nurseries inspected.
104 regular certificates granted.
82 duplicate certificates furnished to be filed in other states.
48 parcels of nursery stock inspected and certified.
49 orchards and gardens examined.
30 shipments, containing 159 cases, 1,997,595 plants, imported nursery stock inspected.
17 shipments or 56.6 per cent. found infested with insects or fungi.
797 apiaries, containing 8,007 colonies inspected.
33 apiaries and 68 colonies found infested with European foul brood.

11 apiaries and 22 colonies found infested with American foul brood.
2,220 letters written on official work.
195 circular letters.
461 post cards.
54 reports to Federal Horticultural Board.
1,614 bulletins, etc., mailed on request or to answer inquiries.
102 packages sent by mail or express.
15 lectures and addresses at institutes, granges and other meetings.

Publications of Entomological Department, 1922

By W. E. BRITTON:

Twenty-first Report State Entomologist of Connecticut (Bulletin 234), 94 pages, 6 figures, XVI plates; 10,500 copies distributed in April, 1922.

Control of Ant Invasions, Bulletin of Immediate Information No. 17, 6 pages, 1,000 copies, July, 1922.

The Gipsy Moth Quarantine, Bulletin of Immediate Information No. 18, 4 pages, 1,000 copies, August, 1922.

Report of Committee on Injurious Insects, Proceedings 31st Annual Meeting Connecticut Pomological Society (3 pages), page 71, 1922.

New Facts Regarding Insects Attacking Vegetables and their Remedies, Proceedings 9th Annual Meeting Connecticut Vegetable Growers' Association (7 pages), page 44, 1922.

Preparedness for Insect Control, Market Grower's Journal, page 12, June 15, 1921.

Potato Spraying, New Haven County Farm Bureau News, June, 1922.

Tobacco Plants Injured by the Seed Corn Maggot, Journal of Economic Entomology, Vol. 15, page 275, 1922.

Skeletonizers on Apple and Birch Trees, New Haven County Farm Bureau News, page 2, October, 1922.

By W. E. BRITTON, M. P. ZAPPE and E. M. STODDARD:

Experiments in Dusting *versus* Spraying on Apples and Peaches in Connecticut in 1921, Bulletin 235, 20 pages, 5 figures, 6 plates, 10,500 copies distributed in April, 1922.

Results on Apples and Peaches in Connecticut, Bulletin No. 2, Crop Protection Digest, page 7, February, 1922.

By W. E. BRITTON and S. T. SEALY:

Mosquito Work in Connecticut in 1920, Eighth Report New Jersey Mosquito Extermination Association, page 64, 1922.

By M. P. ZAPPE and E. M. STODDARD:

Results of Dusting *vs.* Spraying on Apples and Peaches in Connecticut, Proceedings 31st Annual Meeting Connecticut Pomological Society, page 77, 1922.

By PHILIP GARMAN:

The Grass-Feeding Frog-Hopper or Spittle-Bug, Guide to Nature, Vol. XIV, page 165, May, 1922 (2 pages, 3 illustrations).

DEPARTMENT STAFF AND WORK

W. E. Britton, Ph.D., *State and Station Entomologist.*
B. H. Walden, B.Agr., *Photographic and General Work.* } *Assistant*
M. P. Zappe, B.S., *Inspection and General Work.* } *Entomologists.*
Philip Garman, Ph.D., *Research Work.*
John T. Ashworth, *Deputy in charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Samuel T. Sealy, *Deputy in Charge of Mosquito Work.*
Miss Gladys M. Finley, *Clerk and Stenographer.*

H. W. Coley, Westport, } *Apiary Inspectors.*
A. W. Yates, Hartford, }

There have been no changes in the personnel of the Department during the year. Messrs. Frank D. Luddington and J. Leslie Rogers were employed between July 1 and October 1 to aid in the inspection of nurseries.

Mr. Walden has continued his investigations of the American raspberry beetle, *Byturus unicolor,* but as certain points in its life history need to be settled and control measures tested further, another season's work will be devoted to it before publishing the results. Mr. Walden is also making a general survey of the insects attacking small fruit crops in Connecticut.

Mr. Zappe, in co-operation with Mr. Stoddard of the Botanical Department, has carried out a series of tests of copper-arsenate and sulphur-arsenate dusts with and without nicotine on apple orchards in comparison with spraying for the control of the common insect and fungous diseases. Similar tests with sulphur dusts versus atomic sulphur sprays were made on peach orchards. The results of this work have been published in Bulletin No. 245 of this Station.

Copper dusts were compared with spray on potatoes, nicotine dusts were given a trial in killing aphids on turnips and arsenate dusts in killing the green worms on cabbages.

Mr. Zappe has conducted small-sized experiments in controlling the cabbage root maggot, and in the use of paradichlorobenzene to kill peach borers. He has also had charge of inspecting the nurseries, and of inspecting the imported nursery stock consigned to points in Connecticut.

Messrs. Zappe, Walden and Stoddard applied various materials to a dormant apple orchard in Mount Carmel to control the San José scale.

Dr. Garman has continued his investigations on the life histories of our native spittle bugs (family Cercopidæ) and read a paper before the meeting of the Entomological Society of America in Boston, December 26, on the "Life History of the Alder Spittle Bug, *Clastoptera obtusa",* which will probably be published in the *Annals* of that Society or some other entomological journal.

Dr. Garman has further investigated the European red mite, *Paratetranychus pilosus* and tested a number of materials in controlling it; he has also studied the spruce mite, *Paratetranychus ununguis,* and has found several species of mites new to Connecticut.

Dr. Garman has devoted some time to the life history of the apple and thorn skeletonizer, *Hemerophila pariana,* and has collaborated with Dr. B. A. Porter of the Wallingford field station of the Bureau of Entomology in the preparation of an account of this insect which has been published as Bulletin No. 246 of this Station.

Dr. Garman has nearly completed the manuscript of a Bulletin on the Odonata or Dragonflies of Connecticut to be published some time in the future by the Connecticut Geological and Natural History Survey.

The apiary inspection work has been done as in past years by Messrs. H. W. Coley and A. W. Yates on a *per diem* basis.

Mr. Sealy has continued to serve as Deputy to the Director in Charge of Mosquito Elimination; very little new work has been done, but the ditches have been maintained and a number of preliminary surveys made.

Mr. Ashworth, Deputy in Charge of Gipsy Moth Control Work, and his Field Assistant, Mr. J. A. McEvoy, have been unusually busy on account of the increased territory to be covered because of the recent spread of this insect by winds. This work has been done in co-operation with the Federal Bureau of Entomology and a full account of it appears in this Report.

The Entomologist has attended to the executive work of the Department, has continued to aid the Federal Bureau of Entomology in gathering data and submitting reports for the Insect Pest Survey, and has spent much time in reading proof on the Hemiptera of Connecticut, which is now in press and soon to appear as Bulletin No. 34 of the Connecticut Geological and Natural History Survey. He has also devoted some time to the work of the Tree Protection Examining Board.

Substantial additions to the insect collection of the Station have been made during the year, particularly by Mr. Zappe in the Coleoptera, Mr. Walden in the Hemiptera and Dr. Garman in the Odonata. Messrs. Britton, Walden, Zappe and Garman have also done more or less general collecting, the total resulting in the addition of many new records and several species not before represented by Connecticut material in the collection.

The more important activities of the Department not prepared for publication elsewhere are described in the following pages of this Report.

ENTOMOLOGICAL FEATURES OF 1922.

The summer of 1922 was somewhat abnormal. It was characterized by cool, dry weather until June 1, then an abundance of rain until September 1. There were several hard frosts in April and one May 1st, just before the fruit trees blossomed. In some apple orchards, the buds were so seriously injured that whole clusters dropped off without opening; in some other cases, particularly with the McIntosh variety, the pistils were injured so that little or no fruit set. At harvest time it was rather common to find apples with well defined russet rings, a result of frost injury.

Perhaps the two most outstanding entomological features of the season were the rapid spread of the apple and thorn skeletonizer, *Hemerophila pariana* Clerck, and the discovery of an extensive wind-spread of the gipsy moth, *Porthetria dispar* Linn., which occurred in 1921.

The apple and thorn skeletonizer is a European pest discovered in this country in Westchester County, New York, in 1917, and was first found in Connecticut at Greenwich and Stamford in November, 1920. In 1921, specimens of the work of this insect were received from, or observed in, all parts of the State except Windham County. Some of the unsprayed trees in Fairfield County were brown. In 1922, the insect was observed in Windham and all other Counties of Connecticut, and it has spread northward into Massachusetts as far as Amherst. Nearly all unsprayed apple trees around New Haven were brown in late summer, and this condition prevailed along the turnpike leading from New Haven to Hartford. On the other hand, it was reported that in Greenwich and Stamford the injury was less severe than in 1921. Sprayed orchards were not injured. For a more complete account of this insect, the reader is referred to Bulletin No. 246 of this Station, which is included (pages 245-264) in the Annual Report for 1922.

The gipsy moth wind-spread increased the territory to be covered in control work from 27 towns having an area of 634,790 acres or 991 square miles in 1920-1921, to 90 towns infested in 1922. These towns have an area of 1,869,733 acres or 2,921 square miles, or nearly three times the area of two years ago.

The infested region quarantined by the Federal Horticultural Board effective July 1, 1922, and by the State of Connecticut effective July 20, 1922, includes 95 towns. Full details of the gipsy moth conditions will be found on page 290 of this Report.

The brown-tail moth has apparently disappeared from the State, as the only winter nests seen in Connecticut during the year were some which were intercepted on apple seedlings imported from France.

Fruit Insects

The tent caterpillar, *Malacosoma americana* Fabr., is slowly increasing, and the nests were more abundant in 1922 than in 1921.

The Oriental peach moth, *Laspeyresia molesta* Busck, was found in peach twigs at New Canaan in September.

The bud moth, *Tmetocera ocellana* Schiff., was rather less abundant in 1922 than usual.

The fall canker worm, *Alsophila pometaria* Harris, was locally abundant as usual, and caused a moderate amount of damage in unsprayed orchards.

The apple maggot, *Rhagoletis pomonella* Walsh, was somewhat less abundant than usual, yet caused much injury in certain orchards.

The apple twig miner, *Marmara elotella* Busck, which makes the serpentine mines underneath the outer bark of apple twigs, was very abundant in one orchard in Branford. This insect does not cause serious damage.

The plum curculio, *Conotrachelus nenuphar* Herbst, was very abundant and caused much injury to apples, plums and cherries in all parts of the State. It is really a serious apple pest and some better means of controlling it are needed. Of course, cleaning up the rubbish in and around the orchard and removing hedgerows, stone heaps and walls where the beetles are supposed to hibernate will aid considerably in reducing the injury caused by the attacks of this insect.

The buffalo tree hopper, *Ceresa bubalus* Fabr., has been very abundant in the region of North Haven, Branford and North Branford. In one orchard of small trees, all the branches were covered with scars caused by the females in laying eggs.

There was very serious injury in May and June by the rosy apple aphid, *Anuraphis roseus* Baker, in all sections of the State. On some trees where no treatment was given the entire crop of apples was ruined except for cider. The green apple aphid, *Aphis pomi* DeGeer, was also abundant, one correspondent stating that the attack was the worst that he had ever seen, yet the green apple aphid never causes as much injury to the season's crop as the rosy apple aphid. Its attack affects the foliage and new growth rather than the fruit.

The European red mite, *Paratetranychus pilosus* Can. & Fanz., was present and caused considerable injury in apple orchards in Branford, North Branford, Greenwich, Milford, and doubtless in other portions of the State.

The light or false apple red bug, *Lygidea mendax* Reuter, caused injury in orchards in many sections of the State.

The pear psylla, *Psylla pyricola* Foerster, was exceedingly abundant in one orchard early in the season and the twigs were thickly covered with eggs. Late sprays of lime-sulphur will kill the eggs, but summer sprays of nicotine with a spreader are often necessary to control this insect.

The rose chafer, *Macrodactylus subspinosus* Fabr., was noticeably less abundant generally than usual, though injury was reported from some localities, particularly northern Litchfield County and around Hartford. Spraying heavily with self-boiled lime-sulphur seems to act as a repellent..

The San José Scale, *Aspidiotus perniciosus* Comst., is on the increase in Connecticut, and a number of orchards where the dormant spray was omitted showed scale-marked fruit at harvest time. Owners should not neglect this treatment, but should apply a mixture of lime-sulphur or miscible oil in March or April.

In a few plantations, injury by the raspberry cane borer, *Oberea bimaculata* Oliv, was observed. Cutting out and burning the infested canes is the only remedy.

Vegetable Insects

The corn ear worm, *Chloridea obsoleta* Fabr., was much less prevalent than in 1921, though it appeared late in the season in some plantations.

The stalk borer, *Papaipema nitela* Guen., was present as usual and caused some injury to corn, potatoes, tobacco, tomatoes and other crops. Specimens were received at the Station from Andover, Bloomfield, Bristol, Harwinton, New Milford and Salisbury.

The Colorado potato beetle, *Leptinotarsa decemlineata* Say, was less abundant than usual.

The margined blister beetle, *Epicauta marginata* Fabr., caused some injury in a potato field in New Haven.

The pea aphid, *Macrosiphum pisi* Kalt., damaged many fields of peas in various portions of the State. Dusting with a two per cent. nicotine mixture gave good results, but this should be done early before the aphids have seriously injured the vines.

The potato aphid, *Macrosiphum solanifolii* Ashmead, appeared in small numbers, but there were no reports of serious injury.

The turnip aphid, *Aphis pseudobrassicae* Davis, killed and injured the turnip plants in many fields during 1922. Dusting seems to be more effective than spraying to control this pest.

Cutworms were very serious around Danbury, and caused much injury to early cabbages.

The striped cucumber beetle, *Diabrotica vittata* Fabr., was abundant and caused the average amount of injury. It was particularly serious at Burnside.

One of the most important discoveries of the year is the presence in Connecticut of an imported beetle, *Anomala orientalis* Waterhouse. The beetles were first collected in a nursery in New Haven in 1920 and again in the same spot in 1921, but we were unable to get them identified until May. This is an Asiatic species which has injured sugar cane in Hawaii, and no one can foretell what its status may be in this country.

Shade Tree and Forest Insects

The elm leaf beetle, *Galerucella luteola* Müll, was reported as being more abundant around Stamford and Greenwich than for five years. It also riddled the leaves of some trees in the village of Glastonbury.

The blue elm beetle, *Altica ulmi* Woods, was brought to the Station September 11 from West Haven where it was feeding on the leaves of elm trees.

The imported poplar and willow beetle, *Plagiodera versicolora* Laich, is spreading eastward into the State from New York, especially along the coast. One correspondent wrote that around Stamford and Greenwich there was scarcely a willow except the pussy willow that was not two-thirds skeletonized.

The fall webworm, *Hyphantria cunea* Dru., was unusually abundant in late summer and fall, particularly in the northern portion of the State, where it defoliated fruit and nearly all kinds of deciduous trees along the roadside.

The maple borer, *Glycobius speciosus* Say, seemed to be more abundant than usual, and specimens of the adult beetles were received from Hamden, New Haven, Plymouth, Ridgefield, Torrington and South Meriden. The Torrington correspondent had killed thirty-five beetles on the trunks of nearby trees. This is probably the most serious pest of the sugar maple in Connecticut, and in many localities the trees are sadly disfigured or killed by its continued attacks.

The woolly maple leaf scale, *Phenacoccus acericola* King, causes more or less injury to sugar maple trees each year in the cities and villages of the State. I have never observed it to be abundant on trees in the open country or woodlands. During 1922, specimens of this insect were received from Bristol, East Haven, Glastonbury, Hamden, New London, Stratford and Wethersfield. It was also observed in New Haven.

The native gray birches, *Betula populifolia,* growing around New Haven and through the central and eastern portions of the State were skeletonized and turned brown in late summer by the birch leaf skeletonizer, *Bucculatrix canadensisella* Chambers.

This insect also attacks to a lesser degree the other species of birches.

The bronze birch borer, *Agrilus anxius* Gory, has been responsible for the recent death of cut-leaf and other European white birch trees in all parts of the State. Several in New Haven and Derby have died during the past year. Though the native birches are not immune from the attacks of this insect, they are much less susceptible to injury than the European white birch, which most people persist in planting.

The injury caused by the arbor vitae leaf miner, *Argyresthia thuiella* Pack., described in last year's Report, page 157, was much less in evidence in 1922, though causing apprehension in some localities. The work of this insect was observed around Norwalk, New Canaan, New Haven and Hamden, and specimens were received from New Canaan, and Wakefield, R. I.

The tupelo or sour gum leaf miner or case bearer, *Antispila nyssaefoliella* Clemens, caused conspicuous injury to black gum trees in the town of Orange just west of New Haven. Several trees had nearly every leaf mined and had turned brown on September 20.

Miscellaneous Insects

Ants were unusually troublesome in houses and gardens in 1922, and many complaints and inquiries were received at the Station. To supply information to correspondents, Bulletin of Immediate Information No. 17 was issued. This Bulletin is reproduced on page 361 of this Report.

There were also the usual number of complaints regarding damage by clothes moths, and of cockroach infestations.

The iris weevil, *Monychus vulpeculus* Fabr., was reported as injuring iris blossoms at South Meriden.

The juniper webworm, *Dichomeris marginellus* Fabr., has caused serious injury to low junipers in ornamental plantings in Keney Park, Hartford, Greenwich and New Canaan. Spraying heavily with lead arsenate is the remedy.

The rhododendron borer, *Sesia rhododendri* Beut., has caused serious injury to plantings of rhododendrons, especially *Rhododendron maximum* in New Haven, Fairfield, Greenwich, Hartford and South Manchester.

* * * * *

The more important of the above-mentioned insects as well as many other species are treated in detail in the following pages of this Report.

INSPECTION OF NURSERIES

The annual inspection of nursery stock as required by law was commenced on July 24, and completed September 30. Mr. M. P. Zappe had charge of this work and was assisted by Messrs. F. D. Luddington and J. Leslie Rogers. Mr. Walden inspected four nurseries and helped in two others. Dr. Garman helped inspect one and Dr. Britton inspected one.

The unusual amount of rainy weather interfered with the work of inspection, as did the dusting and spraying experiments which required that the fruit be scored at time of harvest. There were many days when the entire force was engaged in scoring fruit.

For the most part the nurseries were fairly clean and in good condition. Some are always well cared for and others neglected. Where infestations of serious pests were found the stock had to be destroyed or treated before a certificate was granted. In certain cases a signed agreement to treat at the proper time (such as spraying after the leaves have dropped) was accepted in good faith in lieu of performance, and the certificates issued.

Pests

In 36 nurseries no pests were found. These were mostly small or newly established nurseries, or nurseries specializing in some line of stock not commonly attacked by insects or plant diseases. The chief pests found with the number of nurseries infested by each are as follows:

Insects: Oyster-shell scale, 44; San José scale, 19; scurfy scale, 9; pine leaf scale, 6; Euonymus scale, 5; rose scale, 4; elm scale, 4; tulip tree scale, 2; *Lecanium* on oak, 1; West Indian peach scale, 1; spruce gall aphid, *Chermes abietis,* 21; *Chermes cooleyi,* 5; white pine weevil, 19; woolly apple aphid, 2; green apple aphid, 2; Oriental peach moth, 2; rhododendron lace bug, 2; borers in lilac, 3; borers in peach, sawfly larvae on pine, blister mite on pear, mites on apple, mites on spruce, apple and thorn skeletonizer, poplar leaf beetle, one each.

Plant Diseases: Poplar canker, 31; blister rust on *Ribes,* 9; crown gall, 2; fire blight, 2; apple rust, apple scab and raspberry leaf curl, one each.

In comparison with similar figures obtained last year, the oyster-shell scale again leads in being the most prevalent pest found in nurseries, 44 cases this year instead of 36 cases last year. San José scale was found in 19 nurseries as against 28 last year. The other scale insects were present in about the same proportions as last year, though tulip tree scale was less prevalent. Spruce gall aphid occurred in 21 nurseries instead of 31 last year, but white pine weevil was reported from 19 nurseries instead of

only one last year. Of the plant diseases, poplar canker was the most prevalent, occurring in 31 nurseries instead of 21 last year, and blister rust was found in nine nurseries instead of two last year. In 1921, 25 nurseries were without pests, and this year 36 were found to be uninfested.

Three nurseries have gone out of business since last year, two have changed name and ten new nurseries have started. Three of these were inspected in the spring and certificates issued, in addition to the annual inspection in August and September. These were marked (2) after the names on the list.

Forty-eight separate parcels of nursery stock have been inspected and certificates granted, in addition to the quarantine inspections on account of the gipsy moth.

The nurserymens' list for 1922 contains 101 names, as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1922

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Barnes Bros. Nursery Co.	Yalesville	150	Aug. 25	1279
Barnes Nursery & Orchard Co.	Wallingford	45	Aug. 12	1268
Barton Nursery	Hamden	1	Sept. 12	1298
Beattie, Wm. H.	New Haven	1	Sept. 25	1320
Benbow, A.	Norfolk	1	Sept. 28	1330
Bertolf Bros.	Sound Beach	25	Sept. 30	1334
Brainard Nursery & Seed Co.	Thompsonville	10	Sept. 23	1315
Braley & Co.	Burnside	1	Sept. 2	1294
Bretschneider, A.	Danielson	2	Aug. 11	1265
Bristol Nurseries, Inc.	Bristol	12	Oct. 2	1338
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 23	1273
Burroughs, Thos. E.	Deep River	3	Aug. 30	1281
Chapman, C. B.	Groton	1	Sept. 1	1285
Chapman, C. E.	No. Stonington	4	Sept. 1	1284
Conine Nursery Co.	Stratford	50	Sept. 30	1333
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Aug. 12	1267
Conn. Agr. Exp. Sta. (W. O. Filley, Forester)	New Haven	1	Sept. 30	1336
Connecticut Nursery Co. (E. M. Chadwick, Prop.)	Colchester	1	Sept. 1	1291
Crofut & Knapp Farm	Norwalk	20	Dec. 1	1358
Cross Highway Nurseries	Westport	6	Nov. 4	1345
Dallas, Inc., Alexander	Waterbury	2	Nov. 4	1346
Dowd, F. C.	Madison	1	Nov. 4	1344
Dunlap, Daniel S.	Cromwell	1	Sept. 26	1322
Edgewood Nursery. Vidal, Inc.	Stamford	5	Sept. 21	1312
Elm City Nursery Co., Woodmont Nursery, Inc.	Woodmont and New Haven	155	Sept. 9	1206
Evergreen Nursery Co.	South Wilton	11	Sept. 1	1283
Fairfield Landscape & Nursery Co.	Cannondale	5	Nov. 11	1350

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Falcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Sept. 28	1331
Gardner's Nurseries	Rocky Hill	5	Sept. 26	1321
Geduldig's Greenhouses	Norwich	1	Sept. 1	1289
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	6	Sept. 1	1293
Heath & Co.	Manchester	5	Aug. 11	1262
Hilliard, H. J.	Sound View	1	Sept. 1	1286
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Aug. 11	1260
Holcomb, Irving	Simsbury	1	Aug. 24	1278
Horan & Son, Jas.	Bridgeport	1	Sept. 23	1316
Houstons' Nurseries	Mansfield	4	Aug. 12	1266
Hoyt's Sons Co., Inc., The Stephen	New Canaan	300	Sept. 29	1332
Hunt & Co., W. W.	Hartford	10	Sept. 12	1297
Isselee, Charles	Darien	10	Nov. 21	1353
Jones, William	Norwalk	1	Sept. 19	1309
Kajok, George	New Haven	1	Dec. 16	1360
Kelley, James J.	New Canaan	1		
Kellner, Herman H.	Danbury	1	Sept. 28	1327
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 27	1325
Ladd & Nichols, Inc.	Greenwich	2	Sept. 22	1314
Laddin's Rock Nursery (W. L. Marks, Prop.)	Stamford	5	Nov. 6	1347
Langenbach, F. J.	Norwich	1	Sept. 1	1287
Larkin, P. J.	New London	1	Oct. 23	1340
Mallett Co., George A.	Bridgeport	1	Nov. 3	1343
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	1	Sept. 9	1295
Marigold Farm (H. Kelley, Prop.)	New Canaan	6	Oct. 25	1341
Meier, A. R.	West Hartford	1	Sept. 12	1301
Millane Tree Expert Co., The	Middletown	1	Nov. 21	1354
Munro, Charles	New Haven	1	Aug. 23	1275
New Haven Nurseries Co., The	New Haven	10	Sept. 27	1326
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Nov. 6	1348
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Sept. 1	1288
New London County Nurseries (W. J. Schoonman, Prop.)	New London and Stonington	7	Sept. 16	1305
North-Eastern Forestry Co.	Cheshire	20	Aug. 11	1261
Norwalk Nursery	Norwalk	7	Sept. 21	1310
Oakland Nurseries	Manchester	5	Aug. 11	1263
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	16	Aug. 30	1282
Ouwerkerk & Van der Stam	Yalesville	8	Aug. 15	1270
Park Gardens	Bridgeport	1	Sept. 19	1308
Pequod Nursery Co.	Yalesville	15	Aug. 11	1264
Phelps, J. Wesson	Bolton	1	Nov. 11	1349
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Sept. 16	1304
Pierson, A. N., Inc.	Cromwell	65	Aug. 19	1272

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Polish Orphanage (Rev. L. Bojnowski, Mgr.)	New Britain	1	Sept. 23	1317
Pomeroy, Edwin C.	Northville	1	Sept. 28	1329
Quality Seed Store	Stamford	2	Nov. 18	1352
Reck, Julius	Bridgeport	1	Sept. 19	1307
Richards, Warren	Clinton	1	Aug. 23	1276
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	20	Sept. 15	1302
Ryther, O. E. (2)	Norwich	6	Oct. 25	1342
Saxe & Floto	Waterbury	1		
Scheepers, Inc., John	Sound Beach	10	Sept. 22	1313
Schleichert, J. L.	Bridgeport	1	Nov. 23	1355
Scott, J. W.	Hartford	5	Nov. 18	1351
Seely, C. H.	Darien	1	Sept. 21	1311
Sierman, C. H.	Hartford	5	Sept. 19	1306
South Wilton Nurseries	South Wilton	5	Sept. 1	1290
Stannard Hill Greenhouse (J. E. Brooks, Prop.)	Westbrook	1	Aug. 17	1271
Steck, Charles A.	Bethel and Newtown	2	Sept. 28	1328
Stratfield Nursery Co.	Bridgeport	5	Dec. 12	1359
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	3	Sept. 25	1318
Traendly & Schenck	Rowayton	2	Aug. 12	1269
Upson, R. E.	Marion	1	Sept. 30	1335
Vanderbrook & Son, Chas. L. (2)	Manchester	5	Sept. 12	1299
Van Wilgen & Co.	Branford	6	Aug. 23	1274
Verkade's Nurseries	New London	8	Aug. 29	1280
Vidbourne & Co., J.	Hartford	7	Sept. 12	1300
Wallace Nursery	Wallingford	2	Sept. 26	1324
Watrous, Arthur J.	Meriden	1	Sept. 26	1323
Wild, Henry	Riverside	1	Oct. 10	1339
Wilson & Co., C. E.	Manchester	30	Sept. 16	1303
Woodruff, C. V. (2)	Orange	1	Oct. 2	1337
Yale University Forest School	New Haven	1	Sept. 25	1319
Young, Mrs. Nellie A.	Pine Orchard	1	Sept. 1	1292
Zack, Harry J.	Deep River	1	Aug. 23	1277
Total acreage		1,719		

INSPECTION OF IMPORTED NURSERY STOCK

The number of separate shipments of imported nursery stock inspected in 1922 was about fifty per cent. greater than in 1921, though the number of cases was only twenty-five per cent. greater; the number of plants, however, increased sixty-two per cent. over 1921. The following table shows the number of shipments, cases and plants inspected in Connecticut for the years 1920, 1921 and 1922:

Year	No. of Shipments	No. of Cases	No. of Plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595

About seventy per cent. of the shipments inspected in 1922 were Manetti rose stock and the remaining thirty per cent were young fruit seedlings. All of the rose and fruit stock is imported for the purpose of grafting and budding, in order to grow named varieties.

Nearly all of this inspection work was done by Mr. Zappe, Messrs. Walden, Garman and Sealy assisting at times. The time required to inspect this stock aggregates 260.5 hours or 1.34 months of 26 working days of seven and one-half hours each. The total cost of this work including time of men and traveling expenses amounted to $301.01.

The sources of this imported nursery stock are as follows:

Sources of Imported Nursery Stock, 1922-1923

	No. Shipments	No. Cases	No. Plants
France	13	92	1,459,200
Holland	12	54	390,395
England	5	13	148,000
	30	159	1,997,595

It is interesting to note how the sources of imported stock entering Connecticut have changed during the past few years. Before the world war when all kinds of nursery stock were permitted to enter the United States, Holland and Belgium each furnished three or four times as many shipments and cases as France. After the devastation of Belgium by the German army, the supply from Belgium dropped off until in 1917-1918, no shipments were received direct, though undoubtedly much stock was carried to Holland and shipped from there. No direct shipments have been received from Belgium since.

In 1918-1919, just before the Federal embargo was placed upon the entry of miscellaneous nursery stock, 98 shipments and 937 cases were received from Holland and only 14 shipments and 73 cases from France. Of course, most of the shipments from Holland contained ornamental plants, and particularly many conifers, rhododendrons, azaleas and boxwoods. Since all plants except rose and fruit tree stocks for propagation were prohibited in 1919, a major proportion come from France, though there are nurseries in Holland which furnish rose and fruit tree stocks.

The following table shows the quantity of stock as inspected by months:

Month	No. Shipments	No. Cases	No. Plants
December	4	19	120,000
January	5	36	672,900
February	11	70	838,340
March	4	9	41,490
April	6	25	324,865
	30	159	1,997,595

In addition to the stock reported above, one shipment of three cases containing 30,000 fruit stocks was reshipped to Dansville, New York, and was not inspected in Connecticut. Two shipments of two cases containing 600 lily bulbs, and 21 shipments of 24 cases of seeds entered Connecticut but were not inspected.

Of the 30 shipments inspected, 17 shipments or fifty-seven per cent. were found to contain insects or other animals or plant diseases, some of which are well-known pests. Details regarding these infestations are given below:

Pests Found on Imported Nursery Stock.

17 Shipments Infested

INSECTS

Agrilus galls on Manetti rose. (1 shipment) V. Lebreton's Nursery, La Pyramide, France.

Diprion cocoon on fruit stock. (1 shipment) Georges Benard, Orleans, France.

Emphytus cinctus Linn., on Manetti rose. (11 shipments) R. H. Bath, Ltd., Wisbech, England; M. Gielen, Oudenbosch, Holland; S. Bide & Sons, Farnham, England; H. H. Woldering, Veendam, Holland; Georges Benard, Orleans, France; V. Lebreton's Nursery, La Pyramide, France; Fa. As. Ouwerkerk, Boskoop, Holland; N. Levavasseur & Fils, Ussy, France; Societe Nurseries Louis Leroy, Angers, France; Arthur Charlton & Sons & Rotherfield, Tunbridge Wells, England.

Euproctis chrysorrhoea Linn., Brown-tail nest on apple. (1 shipment) Aubert Hemeray, Orleans, France.

Noctuid cocoon on Manetti rose. (1 shipment) N. Levavasseur & Fils, Ussy, France.

Rhabdophaga salicis Schrk. galls on tying willows. (1 shipment) M. Gielen, Oudenbosch, Holland.

Spider's eggs on fruit stock (1 shipment) Georges Benard, Orleans, France.

PLANT DISEASES

Crown Gall on Manetti rose. (10 shipments) R. H. Bath, Ltd., Wisbech, England; S. Bide & Sons, Farnham, England; Georges Benard, Orleans, France; V. Lebreton's Nursery, La Pyramide, France; H. H. Woldering, Veendam, Holland; Societe Nurseries Louis Leroy, Angers, France; W. Fromow & Sons, Windlesham, England; Association Flora, Boskoop, Holland.

INSPECTION OF APIARIES

During 1922, this work was carried on in the same manner as in preceding years, Mr. H. W. Coley of Westport serving as inspector in Fairfield, New Haven, Middlesex and New London Counties, and Mr. A. W. Yates of Hartford serving as inspector in Litchfield, Hartford, Tolland and Windham Counties, each being paid six dollars per day and expenses. This work required

a total of 157 man days, and the entire cost for the season was $2,062.77.

More apiaries were inspected in 1922 than in 1921, and a much larger number of colonies. In fact, a noticeable feature of this work was the greater average number of colonies per apiary than in the preceding two years. The following figures show the number of apiaries and colonies inspected, and the average number of colonies per apiary for the past three seasons:

Year	No. Apiaries	No. Colonies	Average No. Colonies Per Apiary
1920	762	4,797	6.5
1921	751	6,972	9.2
1922	797	8,007	10.04

In 1922, inspections were made in 125 towns as against 122 towns in 1921. No apiaries have ever been inspected in the towns of Union (Tolland County) and Eastford (Windham County).

In 1922, inspections were made in the following 26 towns not visited in 1921:

Fairfield County: Bridgeport, Darien and Weston; *New Haven County*: Bethany, East Haven and West Haven; *New London County*: Colchester and Lyme; *Litchfield County*: Bridgewater, Canaan, Cornwall, Goshen, Kent, New Milford, Norfolk, North Canaan, Salisbury, Sharon and Torrington; *Hartford County*: Bloomfield; *Windham County*: Brooklyn, Canterbury, Killingly, Plainfield, Scotland and Sterling.

On the other hand in 1921 inspections were made in the following 23 towns not visited in 1922: *Fairfield County*: Danbury, Ridgefield, Stratford and Trumbull; *New Haven County*: Ansonia, Derby and Meriden; *Middlesex County*: Cromwell, East Haddam, Haddam, Middlefield, Middletown and Portland; *New London County*: Lisbon; *Litchfield County*: Harwinton, New Hartford and Watertown; *Hartford County*: Farmington and Marlborough; *Tolland County*: Stafford; *Windham County*: Chaplin, Putnam and Thompson.

European Foul Brood:

Out of the 797 apiaries and 8,007 colonies inspected in 1922, 33 apiaries and 68 colonies were found infested with European foul brood. This gives a ratio of 4.14 per cent. of apiaries and .85 per cent. of colonies infested, against 3.99 and 1.26 per cent. respectively in 1921. With this exception, European foul brood has gradually decreased in Connecticut since the inspection work began in 1909. In 1922 this disease was found in each county in the State, and in the following 22 towns: *Fairfield County*: Greenwich and Fairfield; *New Haven County*: Milford, Naugatuck, Wallingford and West Haven; *Middlesex County*: Durham; *New London County*: Groton, Norwich, Old Lyme and

Stonington; *Litchfield County*: Thomaston and Torrington; *Hartford County*: Bristol, East Granby, Glastonbury, Newington, Southington, West Hartford and Windsor; *Tolland County*: Ellington; *Windham County*: Killingly.

American Foul Brood:

Of the 797 apiaries and 8,007 colonies inspected in 1922, 11 apiaries and 22 colonies were infested with American foul brood. This is a ratio of 1.38 per cent. of apiaries and .27 per cent. of colonies infested, as against 2.5 and .56 per cent. respectively in 1921. American foul brood was not found during the early years of inspection and was not discovered in the State until 1914. Since then, there has never been very much of this disease, but the percentage is spasmodic and erratic. It fluctuates irregularly, and has shown no such gradual change as has been the case with the decrease in the European foul brood.

In 1922, this disease occurred in all except New London and Windham Counties, and was found in the following seven towns: *Fairfield County*: Greenwich; *New Haven County*: Wallingford; *Middlesex County*: Durham; *Litchfield County*: Washington and Winchester; *Hartford County*: New Britain; *Tolland County*: Mansfield.

The statistics of the apiaries inspected in each of the 125 towns visited, arranged by counties, are given on the following pages, and summarized on page 289.

APIARIES INSPECTED IN 1922

	No. Apiaries		No. Colonies		Foul Brood		
Fairfield County:	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
Bethel	3	0	41	0	0	0	0
Bridgeport	1	0	44	0	0	0	0
Darien	9	0	103	0	0	0	0
Easton	3	0	82	0	0	0	0
Fairfield	5	1	95	3	0	3	0
Greenwich	12	3	110	6	3	1	2
Monroe	3	0	18	0	0	0	0
New Canaan	8	0	69	0	0	0	0
Newtown	1	0	42	0	0	0	0
Norwalk	6	0	65	0	0	0	0
Redding	1	0	31	0	0	0	0
Shelton	1	0	31	0	0	0	0
Stamford	14	0	193	0	0	0	0
Weston	4	0	44	0	0	0	0
Westport	10	2	152	3	0	0	3
Wilton	9	1	125	1	0	0	1
	90	7	1,245	13	3	4	6

	No. Apiaries		No. Colonies		Foul Brood		
New Haven County:	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
Beacon Falls	2	0	4	0	0	0	0
Bethany	5	0	10	0	0	0	0
Branford	5	0	40	0	0	0	0
Cheshire	7	0	75	0	0	0	0
East Haven	5	0	25	0	0	0	0
Guilford	2	0	24	0	0	0	0
Hamden	5	0	44	0	0	0	0
Madison	4	0	30	0	0	0	0
Middlebury	3	0	23	0	0	0	0
Milford	7	1	77	1	0	1	0
Naugatuck	7	2	35	3	0	1	2
New Haven	7	0	49	0	0	0	0
North Haven	1	0	90	0	0	0	0
Oxford	3	0	33	0	0	0	0
Prospect	9	0	77	0	0	0	0
Seymour	2	0	24	0	0	0	0
Wallingford	33	9	212	11	3	5	3
Waterbury	10	0	119	0	0	0	0
West Haven	1	1	6	1	0	1	0
Woodbridge	6	0	59	0	0	0	0
	124	13	1,056	16	3	8	5
Middlesex County:							
Chester	6	0	52	0	0	0	0
Clinton	3	0	28	0	0	0	0
Durham	9	4	166	7	3	4	0
Essex	3	1	41	1	0	0	1
Killingworth	2	0	13	0	0	0	0
Old Saybrook	2	0	23	0	0	0	0
Saybrook	5	1	12	1	0	0	1
Westbrook	1	0	7	0	0	0	0
	31	6	342	9	3	4	2
New London County:							
Bozrah	2	0	26	0	0	0	0
Colchester	6	0	24	0	0	0	0
East Lyme	2	0	3	0	0	0	0
Franklin	2	0	18	0	0	0	0
Groton	8	1	36	2	0	2	0
Lebanon	4	0	53	0	0	0	0
Lyme	1	0	36	0	0	0	0
Montville	2	0	14	0	0	0	0
New London	7	1	72	1	0	0	1
No. Stonington	1	0	1	0	0	0	0
Norwich	9	1	562	1	0	1	0
Old Lyme	3	2	43	8	0	8	0
Preston	6	0	68	0	0	0	0
Stonington	1	1	22	2	0	2	0
Waterford	3	0	28	0	0	0	0
	57	6	1,006	14	0	13	1

	No. Apiaries		No. Colonies		Foul Brood		
Litchfield County:	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
Barkhamsted	3	0	98	0	0	0	0
Bridgewater	5	0	67	0	0	0	0
Canaan	7	0	38	0	0	0	0
Colebrook	2	0	16	0	0	0	0
Cornwall	5	0	20	0	0	0	0
Goshen	1	1*	37	1*	0	0	0
Kent	2	0	9	0	0	0	0
Litchfield	6	0	31	0	0	0	0
Morris	6	0	55	0	0	0	0
New Milford	10	0	118	0	0	0	0
Norfolk	4	0	15	0	0	0	0
North Canaan	9	0	112	0	0	0	0
Plymouth	1	0	18	0	0	0	0
Salisbury	8	0	110	0	0	0	0
Sharon	4	0	103	0	0	0	0
Thomaston	2	1	8	1	0	1	0
Torrington	10	1	113	2	0	2	0
Washington	6	1	133	5	5	0	0
Winchester	16	2	108	3	3	0	0
	107	6	1,209	12	8	3	0

* Paralysis.

Hartford County:							
Avon	1	0	6	0	0	0	0
Berlin	20	0	285	0	0	0	0
Bloomfield	1	0	22	0	0	0	0
Bristol	14	5	101	16	0	15*	0
Burlington	1	0	4	0	0	0	0
Canton	6	0	57	0	0	0	0
East Granby	6	1	61	3	0	3	0
East Hartford	11	0	78	0	0	0	0
East Windsor	12	0	119	0	0	0	0
Enfield	6	0	56	0	0	0	0
Glastonbury	22	3	178	5	0	4	1
Granby	11	0	99	0	0	0	0
Hartford	19	0	135	0	0	0	0
Manchester	16	0	84	0	0	0	0
New Britain	16	1	159	1	1	0	0
Newington	12	1	93	4	0	4	0
Plainville	3	0	4	0	0	0	0
Simsbury	10	0	70	0	0	0	0
Southington	18	1	135	1	0	1	0
South Windsor	1	0	5	0	0	0	0
Suffield	11	0	98	0	0	0	0
West Hartford	25	1	206	2	0	2	0
Wethersfield	1	0	7	0	0	0	0
Windsor	11	1	59	2	0	2	0
Windsor Locks	4	0	29	0	0	0	0
	258	14	2,150	34	1	31	1

* 1 Paralysis.

	No. Apiaries		No. Colonies		Foul Brood		
Tolland County:	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
Andover	5	0	42	0	0	0	0
Bolton	3	0	23	0	0	0	0
Columbia	1	0	5	0	0	0	0
Coventry	8	0	74	0	0	0	0
Ellington	16	2	80	3	0	3	0
Hebron	2	0	15	0	0	0	0
Mansfield	4	2	61	4	4	0	0
Somers	2	0	16	0	0	0	0
Tolland	1	0	13	0	0	0	0
Vernon	7	0	37	0	0	0	0
Willington	18	0	97	0	0	0	0
	67	4	463	7	4	3	0
Windham County:							
Ashford	2	0	12	0	0	0	0
Brooklyn	2	0	78	0	0	0	0
Canterbury	2	0	19	0	0	0	0
Hampton	8	0	36	0	0	0	0
Killingly	11	1	41	2	0	2	0
Plainfield	16	0	77	0	0	0	0
Pomfret	7	0	92	0	0	0	0
Scotland	4	0	54	0	0	0	0
Sterling	2	0	7	0	0	0	0
Windham	6	0	75	0	0	0	0
Woodstock	3	0	45	0	0	0	0
	63	1	536	2	0	2	0

SUMMARY

		No. Apiaries		No. Colonies		Foul Brood		
County	No. Towns	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood
Fairfield	16	90	7	1,245	13	3	4	6
New Haven	20	124	13	1,056	16	3	8	5
Middlesex	8	31	6	342	9	3	4	2
New London	15	57	6	1,006	14	0	13	1
Litchfield	19	107	6*	1,209	12*	8	3	0
Hartford	25	258	14*	2,150	34*	1	31	1
Tolland	11	67	4	463	7	4	3	0
Windham	11	63	1	536	2	0	2	0
	125	797	57	8,007	107	22	68	15

* One colony with paralysis.

	No. Apiaries	No. Colonies
Inspected	797	8,007
Infested with European foul brood	33	68
Per cent. infested	4.14	.85
Infested with American foul brood	11	22
Per cent. infested	1.38	.27
Sacbrood	11	15
Bee paralysis	2	2
Average number of colonies per apiary		10
Cost of inspection		$2,062.77
Average cost per apiary		$2.60
Average cost per colony		.257

Registration of Bees

Chapter 174 of the Public Acts of 1919 provides that all beekeepers shall register their apiaries with the town clerk in the town where the bees are kept each year before October 1. Evidently this law is misunderstood, as many beekeepers seem to think that if they register once, that it fulfills the requirements. Unless enforced, this law is of little or no value.

REPORT OF WORK IN SUPPRESSING THE GIPSY AND BROWN-TAIL MOTHS

Season of 1921-1922

By W. E. Britton and John T. Ashworth

In carrying on this work there has been no marked change or departure from the methods developed in the preceding years. The brown-tail moth has been absent throughout the State so that no measures against it were necessary except to destroy a few larvae in their nests when found on shipments of imported nursery stock. Consequently this report applies almost entirely to suppressing the gipsy moth. As in the past, there has been cordial and complete co-operation between the Federal authorities and our forces in attempting to control this insect, and we wish here to express our appreciation and thanks to Mr. A. F. Burgess, in charge of moth work, and to Mr. H. L McIntyre, in charge of field work, both of the Federal Bureau of Entomology.

The report of this work for the year ending June 30, 1921, was printed in Bulletin 234 of the Connecticut Agricultural Experiment Station, page 132.

Extensive Wind-Spread

When the preceding report was sent to the printer (1921) the gipsy moth situation in Connecticut was very hopeful, but after scouting in the fall of that year, we found that there had been an extensive wind-spread which not only scattered the colonies

throughout the area already known to be infested, but extended it over many towns to the west and south, which had not hitherto been infested. This discovery necessitated scouting many new towns, and for this purpose additional time and men were needed. It has been known for several years that a warm wind blowing just after the young caterpillars emerge from the eggs, will carry them long distances. Such wind-spread occurs only occasionally, and may not happen again for several years, but this one is perhaps the most extensive one known in Connecticut since the State became infested. Before the winter was over, evidence of the pest was found scattered all over Tolland and Hartford Counties, in five towns in Litchfield County, and in two towns each in New Haven and Middlesex Counties. New London County is all infested except four towns, Colchester, East Haddam, Lyme and Old Lyme, on its western border. Windham County has been infested for several years, except the town of Ashford. As yet the gipsy moth has not been found anywhere in Fairfield County.

Methods of Work

During this year while scouting was being done in outside towns (towns which have not heretofore been infested with gipsy moths), the people being unfamiliar with the work were suspicious of the men walking over their property. The following description of how the work is carried on will be made as plain and simple as possible so that anyone who reads it may fully understand about it.

Scouting

The female moths deposit their eggs in July and August. Scouting may then begin, but can be done better in the fall after the leaves have dropped. A crew is made up of one foreman and four scouts, and each crew works in a separate town. The foreman is given a blue-print map of the town, showing all roads, and the scouts work one side of a road at a time until the entire town is covered. In several places in this report the terms "woodland" and "roadside scouting" have been used. The following will explain the difference and how each is done.

Woodland Scouting:—In scouting woodland, the scouts are lined up about fifteen feet apart in a straight line across one end of the block of woodland to be scouted; each man is guided by the man on his left, and scouts all growth in his strip of fifteen feet. When the line gets to the end of the block, it wheels to the right, the man on the extreme right going back on a line parallel with that which he has just made. All the others guide right this time, and this is repeated until the woodland is finished.

Roadside Scouting:—Roadside scouting is done differently in sections where the degree of infestation is thought to be light or heavy. In territory that is lightly infested, attention is paid more particularly to oaks and apple trees, as the gipsy moth prefers these two kinds of trees both for food and for hibernating. The scouts work one side of the road at a time and examine all trees in the open, around houses, and along woodland edges. If oak trees grow in the edge of the woodland, the men will follow as far as the oak growth extends. Sometimes they find infestations one-half to three-quarters of a mile from the road. If a wooded road, they scout a strip about one hundred feet back from the road. In a full crew, two men would do this strip and the other two would work what is called the back line; this means to work diagonally back and forth and inspect all the oak growth back of the one hundred-foot limit as far as the foreman thinks necessary.

If the town is badly infested the scouts generally meet their marks, that is, they scout from one road until they meet the back line of the road opposite.

Marking Trees

Each man has an identifying mark which he scratches in the outer bark of each tree that he examines; this is the same as signing his name, as no other man uses the same mark. The reason for this is that if the foreman or anyone else should find an egg-mass on the tree, it is easy to ascertain who was to blame for missing it. The foreman is required to put his mark on every tree which he examines behind the scouts, and he is held responsible, the same as the men, for all trees carrying his mark. Some of the most common marks used are ⅂ L V Λ and X

If egg-clusters are found, the colony or infestation is marked with a red dot on the map, and a description of the colony with the owner's name and address written on the back of the map, so that the colony can be found readily by any man working on the force, though not present when the infestation was discovered. The infested trees are marked with white paint with the last number of the year in which the infestation was found; thus for colonies found last year, the trees would be marked "1". At the center of the colony a tree would be marked with what is called the total, thus $\frac{1/4}{21}$ indicates to any scout that the colony was found in 1921 and that four trees were found infested with a total of 21 egg-clusters. Each colony in the town is numbered, beginning with one and numbered successively until the town is finished. This number is placed on a tree near where the total is marked; then if the colony is back from the road it is indicated by white

painted arrows pointing from the numbered post or tree on the roadside to the colony, and placed on trees about 100 feet apart. This system of marking enables any man on the force to find any given colony in any town at any time.

Spraying and Banding Trees

In the spring before the larvae have hatched, all infestations on high and wind-swept locations are visited and the trees banded with "raupenleim" or "tree tanglefoot," to prevent the little caterpillars from going up the trees to feed, and then being blown by the wind to other territory.

After the leaves are half size, spraying may be started. For this purpose the Department has two hand sprayers, one horse-drawn power sprayer and two auto truck power sprayers. The horse-drawn and auto sprayers each have tanks that hold 400 gallons. The system of spraying practiced with these machines is called solid stream spraying; the mixture is pumped through the nozzle in a solid stream with force enough to throw it high over the trees to be sprayed. The stream then breaks into a fine mist which is carried through the foliage by the wind. Thus the work is done quickly. The inside of the trees is also sprayed instead of only the outside. These machines are so constructed that they can pump the water needed from wells, brooks and rivers anywhere, thus saving much time that otherwise would be needed to drive to hydrants or to dip up water to fill the tanks. Where conditions have been favorable, 14 tanks have been pumped over a territory of 10 to 12 acres of woodland in one day, the amount and area depending upon the accessibility and the tree growth.

People observing the scouts at work often remark that the men cannot thoroughly examine a tree so quickly and see anything as small as a gipsy moth egg-cluster. Before the men are sent out into the field on scouting work, they are given a course of training. Each is placed in what is called a "breaking-in crew" in thickly infested towns, and are trained to work slowly at first, then to increase their speed as their eyes become accustomed to the work. By following this method day after day, they are soon able to spot an egg-cluster very quickly.

The foreman of each crew is supplied with a letter of authority and identity, signed by the State Entomologist, which he is required to show when challenged by any property owner.

Labor Conditions

In gipsy moth field work as well as all other kinds of work, the labor question has become a serious problem. It was expected that after the war ended help would be plentiful, but conditions

have changed but very little. The men that make the best scouts are farm or country brought-up boys, but owing to the coal shortage these men in some sections of New England are being paid as high as four dollars per day for cutting cord wood, so it can readily be seen they are not willing or ready to leave home and pay board for a smaller rate of pay. This is only one instance of the labor situation. Factory employees, as a rule, make very poor scouts, and have to be tried out and in many cases discharged as unfit for the work; this, of course, takes time and money, but under present conditions has to be done. Another item of contention among the men is the board question. A large number of private companies allow their help subsistence, and this gives the boarding house keeper a chance to put the price of board far above that of four or five years ago. For example, a scout getting $20.64 a week and paying $12.00 for board has not much left after paying for his clothes and laundry. These figures are given to show what we are up against in regard to help. Owing to the large increase in territory that had to be scouted this year on account of the wind-spread occurring in the spring of 1921, it will be necessary to add a number of scouts to the force now working to cover all the infested territory this next winter.

Equipment

During this year very little new equipment was purchased or needed. Some of the old sprayer hose began to give out the first part of the spraying season, so 1,000 feet of rubber-covered hose were purchased from the Acme Rubber Company of Boston, Massachusetts. The couplings were cut from all the old hose that had been saved from year to year and were used on the new hose, thus saving between four and five dollars on each length of 50 feet. This outlay covers practically all of the money spent on equipment during this fiscal year.

The gipsy moth department now has one Buick six touring car, one Ford touring car, four Ford light trucks, two Netco auto power sprayers, one horse-drawn gasoline power sprayer, two "Double Forester" hand pumps, eight bicycles for patrolling near-by infestations, about 3,800 feet of one-inch hose, nine 25-foot lengths of two and one-half inch suction hose, and the necessary small tools for repairing automobiles, cleaning out infestations, etc.

Details of Work in Each Town.

The details such as number and location of infestations, number of egg-clusters, banding, spraying, etc., for each of the infested towns, arranged by counties, are given in the following pages, and in tabular form on page 310. It will be seen from the

summary on page 313, that work was done in 64 infested towns, 1,008 infestations and 12,446 egg-clusters found and treated; 360 infestations sprayed, also 1,793 other trees sprayed by Federal men, 380 trees banded and 7,025 larvae killed by hand soon after hatching around the infestations. Though our State records give the number of infestations sprayed, the Federal method was to record the number of trees in open country or orchards or the number of acres in woodland sprayed. Thus if these could be reduced to a common measure, the account of the work would be more complete and comprehensible.

Windham County

Ashford—78 Infestations, 166 Egg-clusters

Ashford was scouted by Federal men this year, and 78 infestations were found scattered over all parts of the town. However, all but 23 were single egg-cluster colonies, and none of these were large. One colony of 17 egg-clusters was about one and one-half miles northwest of Ashford post office, and another of 13 egg-clusters on the north side of Westford Hill. The other colonies were all small and not considered dangerous. One and one-half acres of woodland were sprayed by Federal men during the spring.

Brooklyn—22 Infestations, 396 Egg-clusters

Brooklyn was scouted by State men during January and the first part of February. Twenty-two colonies of over five egg-clusters each were found. None of these colonies were very large or dangerous. The largest contained 65 egg-clusters and was found on a white oak and stone wall in a pasture owned by Mr. Well located about one-half mile south of the State road and one mile from the Killingly line. Seventeen of the infestations were sprayed by State men, 3,000 gallons of lead arsenate mixture being used. The men found 103 larvae at the colonies and destroyed them while checking up, most of them being found before the spraying season.

Canterbury—5 Infestations, 309 Egg-clusters

Canterbury was scouted by State men the first of the season and five colonies were located. Of these, two were large enough to be mentioned. The worst one was found in an oak and stone wall on land owned by Mr. Drakes in the northwestern part of the town about one-fourth of a mile from the Hampton line. The scouting records of the past two years have shown that a large colony was situated somewhere in this vicinity and was discovered this year. It contained 10 new and 181 old egg-masses.

This colony and all the others were sprayed by the State crew, 127 pounds of arsenate of lead being used. The other colony was found on an apple tree located on the main road north from Westminster about one and one-half miles from Brooklyn town line, and consisted of 24 new and 23 old egg-clusters. Here 52 larvae were found and destroyed before spraying, but none afterward.

Chaplin—6 Infestations, 120 Egg-clusters

Chaplin was scouted during November and the first of December by State men, six colonies being found, none of which were considered dangerous. The worst one was on land owned by C. W. Morey of Hampton. This was a woodland colony located in the northeastern part of the town at the Hampton line, and contained 28 egg-clusters. All six colonies were sprayed by one of the State machines in the spring, 4,240 gallons of mixture being used. Altogether 11 larvae were found and destroyed.

Eastford—31 Infestations, 466 Egg-clusters

Eastford was one of the first towns scouted by State men this season, 31 colonies and 133 single egg-clusters being found. The only colony that is worthy of mention contained 40 egg-clusters. This colony was on a large pasture white oak on land owned by Mr. B. A. Bosworth, about one-half mile from the Woodstock line. One other might be mentioned. This colony was in an apple orchard owned by Mr. M. Spinks on the north side of the road running east from the cemetery to Ragged Hill, and about one-half mile from the Pomfret line. Twenty-five egg-clusters were found here. Twenty-eight of these colonies were sprayed by State men, 11,400 gallons of mixture being used. During the season both before and after spraying, 127 larvae were found and destroyed.

Hampton—5 Infestations, 134 Egg-clusters

Hampton was scouted by a State crew the last of November and first of December, five colonies and 66 single egg-masses being found. The largest colony was found on an oak in a pasture owned by Mr. Colvin, and situated about one and one-half miles northwest of Hampton village near the Robinson Hill district. It contained 29 egg-clusters. Three of the five colonies were sprayed by the State crew, 700 gallons of spray mixture being used. Two hundred thirty-one larvae were found, practically all of which were found before spraying was done.

Killingly—66 Infestations, 1,201 Egg-clusters

Killingly was used this year as a school to break in new men, therefore it took much longer to scout than in previous years. The results showed 66 colonies and 524 single egg-clusters found. They were evenly distributed over the entire town. Two woodland colonies were scouted in the early fall, one in the extreme northeastern corner of the town on land owned by Mr. C. Pariza, containing 65 egg-masses and extending over about 12 acres; the other was situated about one mile east of Ballouville on land owned by Mr. William Young, where 94 egg-clusters were found scattered over about 15 acres. One orchard infestation might be mentioned. It was located in an orchard owned by Mr. Dan Burlingame and 40 egg-clusters were found. This orchard is located at the State line, about one and one-half miles north of the Providence State road, Fifty-eight colonies were sprayed by State crews in the spring, 162,400 gallons of mixture being used. At two of the woodland colonies, 2,800 gallons were used at each place. One thousand ninety-eight larvae were found and destroyed, most of which were found before spraying.

Plainfield—7 Infestations, 166 Egg-clusters

Plainfield was scouted by State men during December and January. Seven colonies and 98 single egg-masses were found. The largest contained 19 egg-clusters in an apple tree in a pasture owned by Mr. Edward Allen, located between the railroad and State road just north of Plainfield Center. All seven of the colonies were sprayed in the spring by State men, and 17 larvae were found and destroyed.

Pomfret—24 infestations, 507 Egg-clusters.

Scouting was started by State men November 4, and finished January 16. Twenty-four colonies and 174 single egg-clusters were found. The infestation is general throughout the town. Two colonies might be mentioned: one contained 51 egg-clusters found in two white oaks and stone wall on land owned by Mr. Seth Kimball. This colony is located in the section of the town known as Elliotts. The other was found in Mr. A. B. Lapsley's orchard, 36 egg-clusters occurring on 18 trees. This orchard is near the Brooklyn line on the road running south from what is known as the Haskell stand, or the road connecting the villages of Pomfret and Brooklyn. Nineteen of the colonies were sprayed by State men, 5,200 gallons of spray liquid being used, and 226 larvae were found and destroyed during the season.

Putnam—32 Infestations, 776 Egg-clusters

Some woodland scouting was done in Putnam in the early fall, and six colonies were found. Scouting was resumed January 14 and completed February 14, a total of 32 colonies and 210 single egg-clusters being found. One large woodland infestation spread over about 29 acres was found on land owned by Mrs. Leveret Burrill in the northeastern corner of the town; it contained 77 egg-masses. One other containing 95 egg-clusters was found in an apple tree and wall in Mr. Henry Apply's yard on the road leading from Shippee Hill to Putnam Heights. Twenty-six colonies were sprayed by State men, 5,400 gallons of mixture being used, and 2,406 larvae were found and destroyed.

Scotland—7 Infestations, 10 Egg-clusters

Scotland was scouted by Federal men and seven colonies were found, five being single egg-masses. Of the other two, one had three and the other two egg-clusters. No spraying was done, as it was not thought necessary.

Sterling—16 Infestations, 245 Egg-clusters

Sterling was scouted by State men between September 15 and November 2. In all, 16 colonies and 114 single egg-clusters were found. None of the colonies were large or dangerous, the largest containing only 19 egg-clusters on two apple trees in a dooryard owned by Mr. Henry Eskelinen, on the road running north from the State road near the Rhode Island line. The rest were small infestations ranging from five to 12 egg-clusters. Fourteen infestations were sprayed by State men, 2,900 gallons of mixture being used, and 122 larvae were found and destroyed during the season.

Thompson—157 Infestations, 4,045 Egg-clusters

Thompson was scouted by State men. As in preceding years, Thompson proved to be the worst infested town in the State, although even in the present state of infestation, the town is in better condition than in 1917, when there were 275 colonies and 7,255 egg-clusters. By comparing these figures, it can readily be seen that the pest has been kept under control. There are three large colonies, one of 156 egg-clusters, found in 10 apple trees, on oak, maple and stone wall on land owned by Mr. C. H. Brown, situated almost at the Massachusetts line about two miles east of New Boston village. The other two were woodland colonies on land owned by Mr. Allen Bixby, bordering the Midland Division railroad just west of the Brandy Hill State road, 170 egg-clusters

being found at one and 139 at the other. The town is generally infested throughout the entire township. Thompson was the last town to have spraying done in it this season; both State and one Federal truck sprayer were used to try and spray as much as possible before the larvae had grown too large and stopped feeding. In all, 89 colonies were sprayed, 30,800 gallons of mixture being used, and 4,803 larvae found and crushed, most of them before the spraying was done.

Woodstock—75 Infestations, 2,067 Egg-clusters

Woodstock was scouted by State men, 75 colonies and 626 single egg-clusters being found. Woodstock is next to Thompson in degree of infestation, and is generally infested throughout. Four colonies may be mentioned as large and dangerous; two are woodland and two orchard infestations. The largest was found in woodland owned by Mr. Allen Kenyon in the Woodstock Valley district, containing 203 egg-masses. The second woodland colony on two large oaks had 82 egg-clusters and is located about one mile southeast of the colony just mentioned above. The largest orchard infestation contained 120 egg-clusters and is located very near the center of the town, on land owned by Mr. C. F. Colcord. Ninety-six egg-clusters were found on two apple trees in an orchard owned by Mr. William Bates in the southwest corner of the town near the Eastford line. During the summer, 58 of the colonies were sprayed by one of the State crews, 21,800 gallons of mixture being used in the operation. In looking over the colonies, both before and after spraying, 1,271 larvae were destroyed, most of them before spraying.

NEW LONDON COUNTY

East Lyme—1 Infestation, 1 Egg-cluster

Forty-seven miles of roadway were scouted by Federal men, and one single egg-mass found on a maple tree on land owned by Mrs. William Roberts in the village of Niantic. This was an old or last year's infertile egg-cluster, so no further work was done in the town.

Griswold—13 Infestations, 30 Egg-clusters

Griswold was scouted by State men, and although 51 miles of roadway were scouted, the town was not completed. Of the 13 colonies, all but two were singles. One of these on an apple tree in a pasture owned by Mr. S. G. Norman contained nine egg-masses. This colony is located on the north side of Geer Hill. The other was in three white oaks in woodland owned by Mr.

W. A. Sullivan, where 10 egg-clusters were found. This colony is in the northeastern corner of the town near the Plainfield line. The woodland colony was sprayed by State men in the summer. The apple tree had been cut down, and as no brush or trees were near, no spraying was done. Nine hundred and one larvae were destroyed by the men.

Groton—7 Infestations, 8 Egg-clusters

There are two groups of colonies in Groton, one in Noank, and the other in Groton village. All the infestations were single egg-clusters, except one which had two egg-clusters found in Mr. T. C. Montgomery's yard at Noank. No spraying was thought necessary. The scouting in this town was not completed on account of the lateness of the season and pressure of work in other towns.

Ledyard—2 Infestations, 16 Egg-clusters

Owing to the lateness of the season, the scouting in this town was confined to the areas found infested last year. In all, 13 miles of roadway were scouted. Two colonies were found, both on the east side of the road running north and south on the east side of Rose Hill. One of these colonies was in an apple orchard owned by Mr. Leon Zakin, and contained 15 egg-clusters. The other was a single egg-mass in an apple orchard owned by Mr. Conrad Keiney. Both colonies were sprayed by State men in the summer and one larva was found and destroyed.

Montville—5 Infestations, 3 Egg-clusters

The work in Montville was done by Federal men this year. The entire town was not scouted, but 41 miles of roadway were covered in the eastern half of the town. Five infestations were found, three of which were female pupae, one had two egg-clusters and the other one. The colony of two egg-clusters was on a willow tree on land owned by Mr. G. A. Bullard in the Trading Cove district. No spraying or other work was thought necessary in this town.

New London—3 Infestations, 4 Egg-clusters

New London was scouted by Federal men and three infestations were found. Two of these were single egg-clusters and the other had two egg-masses. No spraying was done, as no larvae were found at the colonies in the early summer.

North Stonington—10 Infestations, 126 Egg-clusters

By the time the men were able to scout North Stonington, the season was so far advanced that only the territory around last year's infestations could be examined. Ten colonies were found, one a woodland colony near the Westerly (R. I.) line, on land owned by Miss Doris G. Lewis, where 106 egg-masses were found. The other colonies were all small; one of 10 egg-clusters was found in an orchard owned by Mr. Frank Minor on Wintechog Hill. Both of these colonies were sprayed by State men in the summer, 5,300 gallons of mixture being used, most of it at the woodland colony. Six larvae were found and destroyed.

Preston—4 Infestations, 11 Egg-clusters

The same methods were used in Preston as in North Stonington. It was only partly scouted by State men. Four colonies were found, three of which were single egg-clusters. One of eight egg-clusters was found in two apple trees near the roadside on land owned by Mr. Wyspan near the Lisbon line about one-half mile east of the Quinebaug River. This colony was sprayed by State men in the summer.

Salem—1 Infestation, 1 Egg-cluster

About two-thirds of the town or 32 miles of roadway, were scouted by Federal men. One single egg-mass was found in an apple orchard owned by Mr. A. G. Shorten about one mile west of Gardner Lake. No further work was done during the year.

Stonington—74 Infestations, 127 Egg-clusters

Both State and Federal men worked in Stonington this year. Mr. William Ahearn, Federal Lumber Inspector for this district, scouted during spare time in the Stillmanville and Stonington districts. The State men scouted in areas around last year's infestations. The results show that both villages are generally infested. Most of the colonies were single egg-cluster infestations. Two colonies may be mentioned, one of 10 egg-masses, found in apple trees owned by Mr. A. R. Stillman in Stillmanville, and the other one of eight egg-clusters on roadside elm and maple on south side of State road going west just out of Stillmanville. Ten of the colonies were sprayed by State men in the summer, 55 larvae being found and destroyed. Spraying was done at all places where larvae were found.

Voluntown—6 Infestations, 33 Egg-clusters

The same methods were used in scouting Voluntown as were used in scouting Preston, Griswold and North Stonington. Six infestations were discovered. One colony of 26 egg-clusters was found in a pasture oak owned by Mr. Myron Kinnie, located in the southwestern part of the town near the Griswold line. This oak was cleaned (the loose bark taken off) and watched in the early summer for larvae, but as none were found, it was not sprayed, as the owner, Mr. Kinnie, had no other pasture for his cattle. The other infestations were all singles, except one which had two egg-masses. No other work was done in the town this year.

Waterford—5 Infestations, 7 Egg-clusters

Waterford was scouted by Federal scouts, and 65 miles of roadway, or seven-eighths of the town, covered. Five infestations were found, all of which were in the southeastern part of the town. Three were singles, and two had two egg-clusters each. No spraying or other work was done.

TOLLAND COUNTY

Columbia—10 Infestations, 14 Egg-clusters

The work in Columbia was all done by Federal men. Ten infestations were found, all of which were single egg-clusters except one containing five egg-clusters found on land owned by Mr. George Chowanice. The trees were banded and watched.

Coventry—14 Infestations, 93 Egg-clusters

Coventry was scouted by Federal men. Two large colonies were found, one of 64 egg-clusters in woodland owned by Mr. A. Anderson in the extreme southeastern corner of the town, the other of 23 egg-clusters in an oak on land owned by Mr. H. C. McKnight in the western part of the town. The other infestations were all small. Fifty-four trees were banded at different colonies where it was thought necessary. Three-fourths of an acre of woodland was sprayed, also 42 other trees at places where it was necessary. This work was all done by Federal men.

Hebron—2 Infestations, 5 Egg-clusters

Thirty-seven miles of roadway were scouted by Federal men. One colony and one single egg-mass were found. The colony contained four egg-clusters, and was on land owned by Mr. D. H. Hodge. No other work was thought necessary in this town.

Mansfield—48 Infestations, 157 Egg-clusters

The work in Mansfield was also done under Federal supervision. One large colony of 33 egg-clusters was found in an orchard in Eagleville, owned by Mr. Andrew Vogel. One of eight egg-clusters was found in an orchard about a mile east of the State College at Storrs, owned by Mr. M. Ostiozorky. The other 46 infestations were mostly single egg-masses. In the summer 176 trees at different infestations were sprayed where it was thought most necessary.

Tolland—19 Infestations, 56 Egg-clusters

The scouting in Tolland was not completed, 67 miles of roadway or about two-thirds of the town being covered. Of the 19 infestations, the largest was a colony of 11 egg-clusters in woodland owned by Mr. Karl Tobiassen about one-half mile from the Coventry line. The other infestations were all small; 16 trees were banded with raupenleim where the colony was high and wind-swept. Spraying in this town as well as scouting was done by Federal men. In all, one and one-half acres of woodland and 44 separate trees were sprayed.

Union—94 Infestations, 425 Egg-clusters

As stated in the Report of this Station for 1921, page 134, Union was in the path of the wind-spread of the preceding year, and single egg-cluster infestations were found over the entire town. A similar condition was found last year, and the town is now generally infested. Scouting began on September 15, and was finished on October 26, 94 gipsy moth colonies being found. 45 of which were of one egg-cluster each; 24 colonies contained five or more egg-clusters each. Three of these should be mentioned. The first containing 47 egg-clusters was found in the orchard of Mr. William Kunheardt, in the northwestern corner of the town, about half a mile from the Massachusetts line. The second of 28 egg-clusters was in two apple trees in a field owned by Mr. G. W. Thayer at the junction of the roads from North Ashford and Black Pond. The third was about half a mile northeast of the second, in an orchard owned by Mr. H. M. Lamson, and contained 21 egg-clusters. Twenty-four of these colonies were sprayed in the summer, and 4,500 gallons of spray mixture applied. Both scouting and spraying were done by State men.

Willington—40 Infestations, 145 Egg-clusters

The scouting in Willington was done by Federal men, but the work was not completed. That portion north of a line drawn across the town from East Willington to West Willington, and

containing 58 miles of road, was scouted. Three colonies might be mentioned as dangerous. One of 24 egg-clusters was found in apple trees about one and one-fourth miles from the Stafford line near Roaring Brook, owned by Mr. John Malack. Another of 15 egg-clusters was on apple trees owned by Miss Mary Larar in the Moose Meadow district; and the third colony had 12 egg-clusters in apple trees, owner unknown, in the extreme northeastern part of the town. One hundred thirty-seven trees were sprayed by Government men in the summer.

HARTFORD COUNTY

Berlin—4 Infestations, 18 Egg-clusters

The scouting in Berlin was done by State men, and four infestations found. These were in two groups of two infestations each. One group was in the Kensington district and the other in the southeastern part of the town. The first group mentioned was on land owned by the Shuttle Meadow Golf Club and Mr. James Cimms, and had 10 and five egg-clusters respectively. Fifty-four bands of raupenleim were put on the trees at these colonies and later both were sprayed by Federal men.

Bloomfield—3 Infestations, 32 Egg-clusters

All work done in Bloomfield this season was done by Federal men, but there was not time to complete the town. Three colonies were found. The first one had 16 egg-clusters on an oak owned by Mrs. K. A. Gabb, about one-half mile east of the Bloomfield post office. The second colony of five egg-clusters was found in an oak on land owned by Mr. George F. Woodford about one mile east of the post office. The third colony of 11 egg-clusters was in apple trees owned by Mr. Carl D. Mexcur, about two and one-half miles north of Bloomfield post office. Fifteen trees were banded and 125 trees sprayed in the early summer.

Bristol—1 Infestation, 40 Egg-clusters

One colony was found in Bristol, in apple trees and scrub oaks on land owned by Mr. W. M. Harding about one mile east of the Bristol Reservoir, containing 40 egg-clusters. These were creosoted, three trees were banded, and 82 trees sprayed. This work was all done by Federal men.

Burlington—1 Infestation, 4 Egg-clusters

In Burlington 36 miles of roadway were scouted by Federal men. One colony of four egg-masses was found on land owned

by Mr. E. P. Spencer, and bordering Phelps' Brook, near the New Hartford line. Three trees were banded and 32 sprayed in the season by Federal men.

Canton

Canton was scouted by Federal scouts and nothing found.

East Granby—13 Infestations, 118 Egg-clusters

The infestations in East Granby are scattered all over the entire eastern half of the town. One of 63 egg-masses was found in apple trees owned by Mr. H. Nichleson near the East Granby post office. Two other colonies of nine egg-clusters each were found in the Copper Hill district on land owned by Mr. A. Phelps and E. Kellog. One other colony of nine egg-clusters was found in the southern part of the town near the Windsor line, on an oak owned by Mr. F. Phelps. Three-fourths of an acre of woodland and 85 other trees were sprayed in the season. All work in this town was done by Government men.

East Hartford—2 Infestations, 11 Egg-clusters

All work done in East Hartford this year was under Government supervision. Two infestations were found, one a single and the other a 10 egg-mass colony, the latter in apple trees owned by W. S. and H. J. Honington, and located in the village of East Hartford. Five trees were banded and 50 trees sprayed in the early summer.

East Windsor—2 Infestations, 5 Egg-clusters

Forty-eight miles or about two-thirds of the roadway of this town were scouted. Two infestations were found, both small; they had two and three egg-clusters respectively. No further work was done, as it was not thought necessary. The work in this town was done by Federal men.

Farmington—1 Infestation, 1 Egg-cluster

Federal men scouted a part of Farmington this season, finding one single egg-cluster in an orchard on the bank of the Farmington River near the Unionville post office. No further work was done this year.

Glastonbury—6 Infestations, 37 Egg-clusters

The scouting in this town was done by State men, two colonies and four small infestations being found. One of 15 egg-clusters was found in an orchard near Minnechaug Mountain owned by

Mrs. Hale, another of 17 egg-clusters in an orchard a little east of South Glastonbury owned by the late J. H. Hale. Fifty-five trees were banded, and 195 trees sprayed at these infestations. The banding and spraying were done by Federal men.

Granby—5 Infestations, 5 Egg-clusters

The work in Granby consisted of scouting alone, as only five single egg-clusters were found, three of which were in a direct line running east and west across the southern end of the town; the other two were in the same position at the northern end.

Hartford—1 Infestation, 3 Egg-clusters

The southern third of Hartford was scouted by Federal men, and one colony of three egg-clusters was found on a maple tree at 46 Elliot Street, owned by Mr. J. H. Treloar. Three trees were banded and 27 trees sprayed in the spring by a Government crew.

Manchester—4 Infestations, 11 Egg-clusters

Manchester was scouted by a Government crew and four infestations were found. Two of the colonies were in the village of South Manchester, and another about one mile east of this village. The largest colony, however, was found in apple trees a little east of the village known as Hillstown, owned by Mr. Palmer. At the proper time 18 trees were banded and 50 sprayed by a Federal crew.

Newington—2 Infestations, 7 Egg-clusters

The results of scouting in Newington show that two infestations occurred, one of six egg-masses on apple and maple trees owned by Mr. Patrick H. Martin in the village of Clayton, and the other a single egg-mass in an apple tree owned by Mr. M. P. Anderson near the junction of the railroad and the West Hartford line. In addition to roadside scouting, about 40 acres of woodland were scouted in Newington. Thirteen trees were banded and 29 sprayed. The work in Newington was done by Federal men.

New Britain—2 Infestations, 2 Egg-clusters

Two single egg-clusters were found by Federal men in New Britain about one mile apart in the south central part of the town. No banding or spraying was thought necessary at these infestations.

Plainville—1 Infestation, 3 Egg-clusters

In Plainville 15 of the 25 miles of roadway were scouted by a Government crew. One colony of three egg-clusters was found on apple and maple trees owned by the town and located in the village. Ten trees were banded and 25 sprayed by a Government crew.

Rocky Hill—3 Infestations, 13 Egg-clusters

Rocky Hill was scouted by State men and three infestations found. Two had five egg-clusters each; the first was found in apple trees owned by Mr. Charles Wilber on the State road about one and one-half miles north of the Cromwell line. The second was in apple trees owned by Mr. Fred Sope in the central part of the town. Forty-five trees were banded and later in the spring 80 were sprayed by Federal men.

Southington—1 Infestation, 2 Egg-clusters

One colony of two egg-clusters was found in Southington near the town farm by Federal men. No other work was thought necessary.

Suffield—37 Infestations, 110 Egg-clusters

Gipsy moth infestations were found in all parts of this town. There are three large and dangerous ones, the first being one of 17 egg-clusters on willow trees owned by Mr. William Styles on Muddy Brook just north of Suffield village; the second is one of 10 egg-clusters on oak on the east side of Philo Brook near the Massachusetts line, and the third was found in apple trees near Woods Station, owned by Mr. Charles Cannon. Forty-one trees were sprayed in the spraying season by a Government crew.

Simsbury

Simsbury was scouted by Federal scouts and nothing found.

Wethersfield—2 Infestations, 25 Egg-clusters

In scouting Wethersfield this year, two colonies were found, the largest being one of 15 egg-clusters in apple trees owned by Mr. C. McMullen of Jordan Lane. The other was on apple and peach trees owned by Mr. J. Applebaum of Spring Street, and contained 10 egg-clusters. Fifty-five trees were sprayed at these two places by Government men.

West Hartford—3 Infestations, 9 Egg-clusters

Two of the three infestations in West Hartford are single egg-clusters. The third, however, contained seven egg-clusters found on apple trees owned by Mr. C. S. Griswold on the south side of the Hartford and Winsted State road about one mile from the Hartford line. Five trees were banded and 10 sprayed at this infestation by a Government crew.

Windsor—9 Infestations, 55 Egg-clusters

The work in Windsor was all done by Federal men. Of the 55 egg-clusters, 45 were in two colonies, both being in apple trees beside the State road north of the village of Windsor. One containing 33 egg-clusters was on land owned by Mr. Tony Peters, while the other of 12 egg-clusters was on land owned by Mrs. Brooks. The remaining seven infestations were all small. During the spraying season, 40 trees were sprayed.

LITCHFIELD COUNTY

Barkhamsted—1 Infestation, 1 Egg-cluster

About one-fourth of this town was scouted and one egg-cluster found about one mile south of the Hampsted post office on the line road. The work was done by Federal scouts.

Canaan—1 Infestation, 1 Egg-cluster

The single egg-cluster that was found in Canaan was in an orchard owned by Mr. M. C. Dean, about one and one-half miles east of South Canaan post office. The scouting was done by Government scouts, and no spraying was done in this town.

Colebrook—2 Infestations—2 Egg-clusters

The scouting in Colebrook was done in the North Colebrook section of the town. Two single egg-cluster infestations were found, both on apple trees in the northwestern corner of the town. They were on property owned by Mr. Miles Erisson and Mrs. M. Eskolin. The work was done by Government men.

New Hartford—2 Infestations, 11 Egg-clusters

Federal men did the work in New Hartford. Two infestations were found, one a single egg-cluster in an apple orchard in the Pine Meadow district, owned by Mr. F. W. Jones. The other

had 10 egg-clusters in an orchard owned by Mr. Leon Sekulski about two miles northwest from the Nepaug post office. Thirty trees were banded in the spring, but no spraying was done.

Norfolk—2 Infestations, 2 Egg-clusters

Two single egg-clusters were found in the extreme northeast corner of the town, one in a basswood tree owned by Mr. F. W. Towers, and the other in an apple tree owned by Miss Mary Hurd. The scouting was done by Federal men, and no spraying or other work was thought necessary.

Plymouth—1 Infestation, 4 Egg-clusters

One colony of four egg-clusters was found in an apple tree owned by Mr. C. O. Jesperren in the village of Hancock. In the spring nine trees were banded and later 96 trees were sprayed. This work was all done by Federal men.

The towns of Cornwall, North Canaan, Salisbury, Thomaston and Watertown, all in Litchfield County, were scouted by Federal men and nothing found.

MIDDLESEX COUNTY

Cromwell

Cromwell was scouted by State men this season and no trace of the gipsy moth was found.

Durham

State men scouted Durham. One female pupa was found, but no further work was done.

Haddam

As in the case of Cromwell, the work was done by State men and nothing found.

Middletown—2 Infestations, 7 Egg-clusters

Two infestations were found by State men in Middletown. One was a single egg-mass; at the other six egg-clusters were found in apple trees owned by Mr. Edward W. Lee, located in the Middlefield Center district. Six trees were banded in the early spring, and 20 trees sprayed at this colony by Federal men.

Portland

Portland was scouted by State men this season, but nothing was found.

NEW HAVEN COUNTY

Waterbury—2 Infestations, 12 Egg-clusters

One colony of nine egg-clusters was found in apple trees owned by Mr. Mikel Jinety of 792 Highland Avenue, and one of three egg-clusters on poplar trees owned by the Chase Company of Grand Street. In the spring five trees were banded and later 200 trees were sprayed, all work being done by Federal men.

Wolcott—2 Infestations, 25 Egg-clusters

The scouting in Wolcott was done by State men. Two colonies were found, the largest being one of 19 egg-clusters in woodland owned by Mr. Peter Ferdano and Mr. Willie E. Pretchard about one mile northwest of the Wolcott post office. The other was in an apple orchard one-half mile east of Wolcott post office, owned by Mr. Arthur M. Cole. Federal men banded 28 trees and sprayed 151 trees at these colonies during the spring and early summer.

Cheshire, Meriden, Middlebury and Naugatuck were the other towns scouted in New Haven County, but no traces of gipsy moth were found.

STATISTICS OF INFESTATIONS

Towns.	No. Infestations Found	No. Egg-Clusters Found	No. Colonies Sprayed	No. Trees Banded	No. Larvae Killed	No. Miles Roadway Scouted
Windham County—14 Towns Infested.						
Ashford	78	166	0	0	0	74
Brooklyn	22	396	17	0	103	70.75
Canterbury	5	309	5	0	52	93.50
Chaplin	6	120	5	0	11	46
Eastford	31	466	26	0	127	71
Hampton	5	134	3	0	231	72.33
Killingly	66	1,201	58	0	1,098	121.90
Plainfield	7	166	5	0	17	112
Pomfret	24	507	11	0	226	98.50
Putnam	32	776	26	0	2,406	65
Scotland	7	10	0	0	0	42
Sterling	16	245	14	0	122	65.13
Thompson	157	4,045	89	0	231	145.40
Windham	0	0	0	0	0	2
Woodstock	75	2,067	58	0	1,271	161
Total	531	10,608	317	0	5,895	1,240.51

Towns.	No. Infestations Found	No. Egg-Clusters Found	No. Colonies Sprayed		No. Trees Banded	No. Larvae Killed	No. Miles Roadway Scouted
New London County—12 Towns Infested.							
Colchester	0	0	0		0	0	55
East Lyme	1	1	0		0	0	47
Griswold	13	30	1		0	901	51.63
Groton	7	8	0		0	0	15
Ledyard	2	16	2		0	0	12.75
Montville	5	3†	0		0	0	41
New London	3	4	0		0	0	32
North Stonington	10	126	2		0	6	14.50
Norwich	0	0	0		0	0	5
Preston	4	11	1		0	0	11 & 5 acres
Salem	1	1	0		0	0	32
Stonington	74	127	10		0	55	13
Voluntown	6	33	0		0	46	17
Waterford	5	7	0		0	0	65
Total	131	367†	16		0	1,009	411.88 & 5 acres
Tolland County—7 Towns Infested.							
Columbia	10	14	0		3	0	38
Coventry	14	93	0	43*	54	0	109
Hebron	2	5	0		0	0	37
Mansfield	48	157	0	176	0	0	124
Tolland	19	56	0	44	16	0	67
Union	94	425	24		0	121	72.20
Willington	40	145	0	137	0	0	58
Total	227	895	24	400*	73	121	505.20
Hartford County—21 Towns Infested.							
Avon	0	0	0		0	0	18
Berlin	4	18	2		54	0	86
Bloomfield	3	32	0	125*	15	0	6
Bristol	1	40	0	82	3	0	104
Burlington	1	4	0	32	3	0	36
Canton	0	0	0		0	0	72
East Granby	13	118	0	85	0	0	36
East Hartford	2	11	0	50	5	0	44
East Windsor	2	5	0		0	0	48
Farmington	1	1	0		0	0	12
Glastonbury	6	37	0	195	55	0	101
Granby	5	5	0		0	0	96
Hartford	1	3	0	27	3	0	18
Manchester	4	11	0	50	18	0	92
Newington	2	7	0	29	13	0	16
New Britain	2	2	0		0	0	60
Plainville	1	3	0	25	10	0	15

† Plus 2 pupa cases. * Trees.

Towns.	No. Infestations Found	No. Egg-Clusters Found	No. Colonies Sprayed		No. Trees Banded	No. Larvae Killed	No. Miles Roadway Scouted	
Hartford County—Continued.								
Rocky Hill	3	13	0	80	45	0	37	
Simsbury	0	0	0		0	0	55	
Southington	1	2	0		0	0	95	
Suffield	37	110	0	41	0	0	68	
West Hartford	3	0	0	10	5	0	35	
Wethersfield	2	25	0	55	0	0	30	
Windsor	9	55	0	40	0	0	54	
Total	103	511	2	926*	229	0	1,234	
Litchfield County—6 Towns Infested.								
Barkhamsted	1	1	0		0	0	21	
Canaan	1	1	0		0	0	14	
Colebrook	2	2	0		0	0	17	
Cornwall	0	0	0		0	0	42	
New Hartford	2	11	0		30	0	99	
Norfolk	2	0	0		0	0	22	
North Canaan	0	0	0		0	0	12	
Plymouth	1	4	1	96*	9	0	58	
Salisbury	0	0	0		0	0	35	
Thomaston	0	0	0		0	0	36	
Watertown	0	0	0		0	0	45	
Total	9	21	1	96*	39	0	401	
Middlesex County—2 Towns Infested.								
Cromwell	0	0	0		0	0	47	
Durham	1	0†	0		0	0	69.63	
Haddam	0	0	0		0	0	105.13	
Middlefield	0	0	0		0	0	41	
Middletown	2	7	0	20*	6	0	169	
Portland	0	0	0		0	0	59.63	
Total	3	7†	0	20*	6	0	491.39	
New Haven County—2 Towns Infested.								
Cheshire	0	0	0		0	0	106.50	
Meriden	0	0	0		0	0	112	
Middlebury	0	0	0		0	0	19	
Naugatuck	0	0	0		0	0	11	
Waterbury	2	12	0	200*	5	0	148	
Wolcott	2	25	0	151	28	0	56	
Total	4	37	0	351*	33	0	453.50	

† Plus 1 female pupa case. * Trees.

SUMMARY OF INFESTATIONS

County	No. Towns Infested	No. Infestations	No. Egg-Clusters Destroyed	No. Infestations Sprayed	Sprayed, No. Trees	No. Trees Banded	No. Larvae Killed	No. Miles Roadway Scouted
Windham ...	14	531	10,608	317		0	5,895	1,240.51
New London	12	131	367†	16		0	1,009	411.88*
Tolland	7	227	895	24	400	73	121	505.20
Hartford ...	21	103	511	2	926	229	0	1,234
Litchfield ...	6	9	21	1	96	39	0	401
Middlesex ...	2	3	7‡	0	20	6	0	491.39
New Haven..	2	4	37	0	351	33	0	453.50
Total	64	1,008	12,446	360	1,793	380	7,025	4,737.48 & 5 acres

† Also 2 pupa cases. ‡ Also 1 female pupa case. * Plus 5 acres.

Towns in the Infested Area Which Were Not Scouted

Several towns in the infested area were not scouted on account of lack of time to do the work with the force at our disposal. For instance, if it were discovered that the next adjoining town was infested, it seemed best to skip a town in an attempt to find the limit of the infestation. Some of these towns not scouted are as follows: Tolland County—Andover, Bolton, Vernon, Ellington, Somers and Stafford; Hartford County—Enfield, Hartland, Marlboro, South Windsor and Windsor Locks; and in New London County—Lebanon, Franklin, Sprague, Lisbon and Bozrah.

Parasites

Years ago the State of Massachusetts, in co-operation with the Federal Bureau of Entomology, imported into this country some of the insect parasites of the gipsy moth in Europe, and which, presumably, have helped to hold it in check there. This work afterward was turned over wholly to the Bureau of Entomology. Later, parasites were obtained from Japan. Rearing, observing, colonizing and recovering these parasites has been kept up to the present day, in the belief that in time the effect in sum total of all these parasites would be felt in reducing the ravages of the gipsy moth in this country. During the war and immediately afterward the unsettled condition of affairs in Europe and other countries made it inadvisable to attempt to collect parasites to be shipped to the United States, but in 1922, appropriations being available, trained men were sent to both Europe and Japan, and additional material was gathered and sent to this country.

From time to time information regarding these parasites has been included in this report. Some of the matter here given was taken from the report of this Station for 1920, page 162, but it

has been revised and brought up to date as far as Connecticut is concerned. We are indebted to Mr. A. F. Burgess for much of this information regarding the planting and recovery of parasites, though our men have co-operated with the Federal authorities in this work in Connecticut.

ATTACKING THE GIPSY MOTH

Calosoma sycophanta Linn.

Though not a parasite, both adults and larvae of this large ground beetle devour the caterpillars of the gipsy moth, and it is therefore quite an important agency for holding that species in check. It was liberated in Stonington in 1914, in Thompson in 1915, and in Killingly in 1917. This species now seems to be fairly well distributed over the State, as it has been collected or observed in Thompson, Putnam, Killingly, Scotland, Plainfield, Groton, Lyme, Clinton, New Haven, Meriden and Darien. Our employees have reported observing these beetles feeding upon gipsy moth larvae in Thompson and Killingly in 1920. A large and beautiful specimen of this beetle was seen by the State Entomologist in his yard in New Haven during the summer of 1922.

Two important and promising egg-parasites have been liberated in large numbers within our territory during the past year. One of them, *Anastatus bifasciatus* Fonsc., was first colonized in the State in 1917, the other, *Schedius kuvanae* How., was first liberated in 1921.

Anastatus bifasciatus Fonsc.

This very minute Hymenopterous egg parasite of the gipsy moth in Europe was first liberated in Connecticut in 1917, when colonies were placed in Thompson, Woodstock, Putnam, Killingly, Pomfret, Eastford, Brooklyn, Hampton, Chaplin, Mansfield and Canterbury. More colonies were planted in Brooklyn in 1918, Canterbury 1919, Eastford 1918 and 1919, Griswold in 1918, Hampton in 1918 and 1919, Killingly in 1918 and 1919, Ledyard in 1919, Mansfield in 1918, Norwich in 1919, Plainfield in 1918 and 1919, Pomfret in 1919, Putnam in 1918 and 1919, Scotland in 1918, Sterling in 1918 and 1919, Thompson in 1919, Voluntown in 1918 and 1919, and Woodstock in 1918.

This insect was recovered from Eastford in 1917, and from Voluntown in 1918.

During 1922 this insect was liberated in each of the following towns, the numerals indicating the number of colonies planted in each town: Brooklyn 22, Canterbury 21, Chaplin 10, Eastford 27, Hampton 9, Killingly 10, Plainfield 15, Pomfret 13, Sterling

16, Stonington 15, Union 47, Woodstock 10; making a total of 215 colonies of 2,000 individuals each, or 430,000 individual parasites.

Schedius kuvanae How.

This little Hymenopterous insect is from Japan and was first liberated in the northeastern or most thickly gipsy moth infested portion of the State in 1921, in numbers of individuals and towns as follows: Thompson 768,000, Putnam 386,465, Woodstock 337,960, Killingly 106,350, total 1,598,775 individuals. Mr. McEvoy, who liberated them, saw them start immediately to work on gipsy moth egg-clusters in the vicinity, 81 being counted on one egg-cluster. Observations in southern Massachusetts show that on an average 40 per cent. of the gipsy moth eggs gathered in five towns were parasitized by this little insect.

In 1922, colonies of this parasite were planted in Connecticut as follows:

Woodstock	91 colonies	(376,000 individuals)
Killingly	59 "	(236,000 ")
Union	73 "	(292,000 ")
Total	223 colonies	(904,000 individuals)

Apanteles fulvipes Hal.

This minute Hymenopterous insect parasitizes gipsy moth caterpillars in both Europe and Asia. No attempt has been made to colonize it in Connecticut until 1922, when 2,500 cocoons were placed in Stonington, and 1,200 cocoons in Griswold.

Apanteles melanoscelus Ratz.

This double-brooded Hymenopterous parasite of both gipsy and brown-tail moth caterpillars from southern Europe, is now firmly established in New England. It also attacks several native insects, and is therefore able to complete its life cycle each year. One colony of 500 cocoons was planted in each of the towns of Thompson, Putnam, Woodstock and Stonington, during 1922.

Monodontomerus aereus Walker.

A minute Hymenopterous parasite of the pupae of both gipsy and brown-tail moths. Not colonized in Connecticut but recovered from Putnam in 1911 and 1915, Hartford and Suffield in 1912.

Blepharipa scutellata Desv.

This Dipterous parasite or two-winged fly from Europe attacks the gipsy moth caterpillars, and although introduced many years ago, it was rather difficult to colonize the species successfully. Apparently it is now well established in this country, and for the first time colonized in Connecticut in 1922. One colony of 1,666 puparia was placed in each of the towns of Coventry and North Stonington. During the season this insect was recovered from Hampton, Canterbury and Plainfield.

Compsilura concinnata Meigen.

This is a medium-sized Dipterous parasite or two-winged fly of the family Tachinidae attacking both the gipsy and brown-tail moths. It was colonized at Putnam in 1912, Hartford in 1913, Mansfield, Plainfield and Stonington in 1914, Stafford, Suffield, Colchester, Norwich and Old Lyme in 1915, and Hampton and Scotland in 1917. It has been recovered from Woodstock in 1915, Stonington in 1916, Putnam, Stafford, Plainfield and North Stonington in 1917, Pomfret, Putnam and Stonington in 1918, Killingly, Plainfield, Pomfret, Putnam, Scotland and Thompson in 1919, and from Plainfield, North Stonington and Putnam in 1920. In 1922 it was recovered from Hampton, Brooklyn and Wolcott.

Sturmia (*Zygobothria*) *nidicola* Townsend.

This is another Tachinid fly of medium size parasitizing the larvae of both gipsy and brown-tail moths, and though never colonized in Connecticut, it was recovered from Canterbury and Waterford in 1917, and from Groton and Stonington in 1918.

ATTACKING THE BROWN-TAIL MOTH

Although the brown-tail moth has disappeared from our territory for the time being, it may return. Without doubt the following parasites have played some part in this disappearance, and are included here to make the record of imported parasites more complete.

Apanteles lacteicolor Vier.

This is a small Hymenopterous parasite of the brown-tail moth larvae. It has been colonized in Connecticut as follows: Putnam in 1912, Suffield, Hartford, Mansfield, Norwich, Stonington, Griswold, Plainfield, Killingly and Hampton in 1913, Manchester, Chester, Colchester and Lebanon in 1915, East Lyme and Canterbury in 1916, Montville and Groton in 1917.

This species has been recovered as follows: Brooklyn 1916, Canterbury 1917, East Hartford 1916, Groton 1918, Hartford 1913 and 1914, Killingly 1916, Lebanon 1915, Pomfret 1913, Putnam 1917, Stafford 1917, Stonington 1915, Suffield 1915, Thompson 1913 and 1916, Waterford 1914, 1916 and 1917, Wethersfield 1916, and Woodstock 1913, 1915 and 1916.

Pteromalus egregius Forst.

A minute Hymenopterous parasite of the brown-tail caterpillars not colonized in Connecticut, but recovered from Hartford in 1913 and 1914, and Putnam in 1915.

Meteorus versicolor Wesm.

This is a minute Hymenopterous parasite of the brown-tail caterpillars, and though no attempt was ever made to colonize the species in Connecticut, probably some cocoons were mixed with those of *Apanteles lacteicolor* and thus it became distributed. It was recovered from Hartford in 1914 and from Brooklyn, Killingly, Thompson and Woodstock in 1916, and from Groton in 1918.

The parasites mentioned on the preceding pages are apparently becoming effective in some portions of the thickly infested areas of Massachusetts, as defoliation was very severe in certain sections in 1921, and was much less so in most of these areas in 1922. It is reasonable to expect that the combined attacks of these different parasites may in time bring about an appreciable diminution of the gipsy moth pest.

The Gipsy Moth Quarantine*

On account of the recent spread of the gipsy moth in Connecticut, the quarantined area has been extended to include many more towns than were involved in the Federal Quarantine of 1921, or the State quarantine of March 23, 1920, (See Quarantine Order No. 2). The present quarantine was established by the Federal Horticultural Board, effective July 1, 1922, and by the State of Connecticut by Quarantine Order No. 4, effective July 20, 1922, as follows:

*Published as Bulletin of Immediate Information No. 18, August, 1922.

STATE OF CONNECTICUT

AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

QUARANTINE ORDER No. 4

Concerning Gipsy Moths

In order to protect uninfested parts of Connecticut from danger of infestation by the gipsy moth, under authority given in Section 2106 of the General Statutes, the following regulations are hereby established.

1. The following towns are hereby placed under quarantine because of the gipsy moth:

HARTFORD COUNTY:

Avon	Farmington	Plainville
Berlin	Glastonbury	Rocky Hill
Bloomfield	Granby	Simsbury
Bristol	Hartford	Southington
Burlington	Hartland	South Windsor
Canton	Manchester	Suffield
East Granby	Marlborough	West Hartford
East Hartford	New Britain	Wethersfield
East Windsor	Newington	Windsor
Enfield		Windsor Locks

LITCHFIELD COUNTY:

Barkhamsted	New Hartford	Salisbury
Canaan	Norfolk	Thomaston
Colebrook	North Canaan	Torrington
Harwinton	Plymouth	Winchester

MIDDLESEX COUNTY:

Cromwell	East Hampton	Portland
	Middletown	

NEW HAVEN COUNTY:

Waterbury	Wolcott	

NEW LONDON COUNTY:

Bozrah	Ledyard	Preston
Colchester	Lisbon	Salem
East Lyme	Montville	Sprague
Franklin	New London	Stonington
Griswold	North Stonington	Voluntown
Groton	Norwich	Waterford
Lebanon		

TOLLAND COUNTY:

Andover	Ellington	Tolland
Bolton	Hebron	Union
Columbia	Mansfield	Vernon
Coventry	Somers	Willington
	Stafford	

WINDHAM COUNTY:

Ashford	Hampton	Scotland
Brooklyn	Killingly	Sterling
Canterbury	Plainfield	Thompson
Chaplin	Pomfret	Windham
Eastford	Putnam	Woodstock

These same towns have already been quarantined by the Federal Horticultural Board of the United States Department of Agriculture, and it shall be unlawful to remove from this quarantined area any woody nursery stock, lumber, cordwood, telegraph or telephone poles, railroad ties, or other forest plant products, unless the products shall have been inspected and certified by an authorized State or Federal inspector.

2. All Connecticut towns quarantined by Quarantine Order No. 2 (dated March 23, 1920) because of the brown-tail moth, are hereby released.

3. In view of possible future changes in the lines between the infested and non-infested areas of the State, the areas quarantined by the State shall conform to those quarantined by the United States Department of Agriculture; furthermore, the regulations established by the Federal Horticultural Board of the United States Department of Agriculture for inter-state shipments, are hereby adopted for the inspection and certification of similar shipments from the quarantined area to points outside of this area within the State of Connecticut.

4. This order shall take effect from its date.

Dated July 20, 1922.

E. H. JENKINS,
Director, Connecticut Agricultural Experiment Station.

Approved:
EVERETT J. LAKE,
Governor.

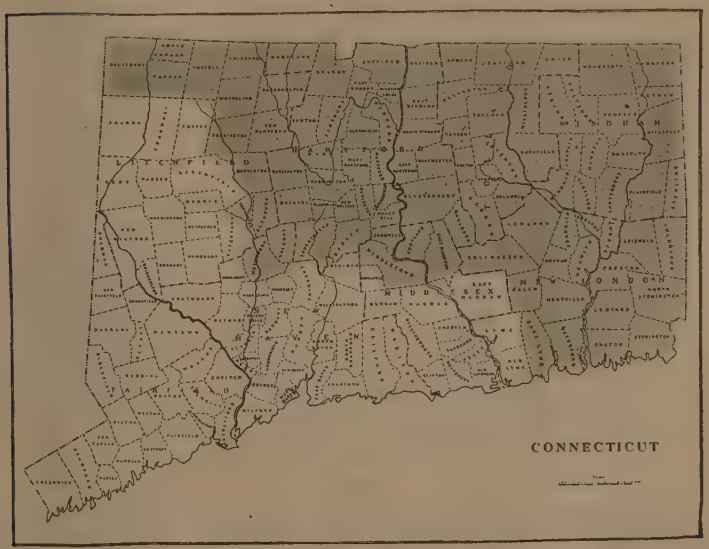


Figure 4. Map of Connecticut showing territory quarantined in 1922 on account of gipsy moth.

Instructions to Nurserymen, Lumbermen, Wood Dealers, Shippers and Transportation Companies

Any shipments of nursery stock, or forest products originating within the quarantined area must not be shipped out of that area into the territory not infested, unless inspected and accompanied by an inspector's certificate. All shipments going into other States must be examined by a Federal Inspector, and the Federal Inspectors have also been authorized to inspect shipments consigned to points within the State: the State inspector can also examine such shipments in case of convenience or if the Federal Inspectors are busy elsewhere.

Transportation companies must not accept nursery stock or forest products consigned to points outside of the infested area unless accompanied by certificate of inspection.

Until an adequate number of Federal inspectors have been assigned to duty in Connecticut, and their districts established, applications for inspection may be made to:

D. M. Rogers, Room 304, 402 Atlantic Ave., Boston, Mass.
In charge of Federal Gipsy Moth Inspection Service.

W. E. Britton, State Entomologist, Conn. Agr. Exp. Station, New Haven, Conn.
In charge of State Gipsy Moth Inspection Service.

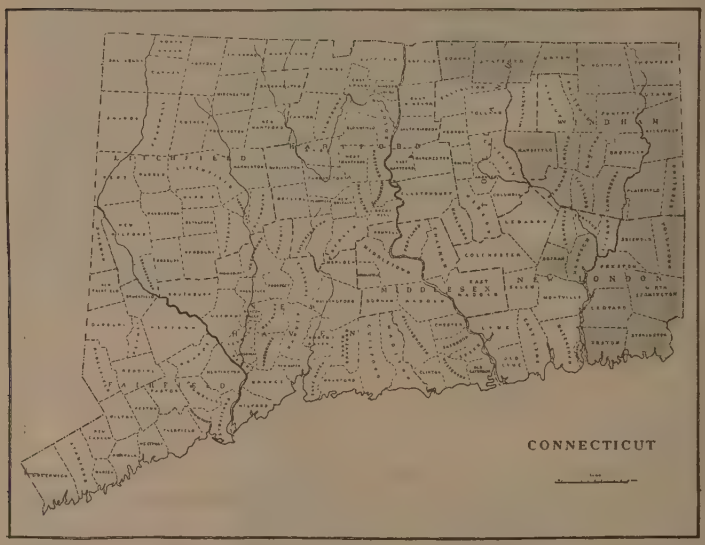


Figure 5. Map of Connecticut showing extent of Federal quarantine in 1921.

Financial Statement

RECEIPTS

Appropriation for biennial period ending June 30, 1923, $60,000.00.

CLASSIFIED EXPENDITURES FOR THE PERIOD ENDING JUNE 30, 1922

Salaries and Wages		$25,105.04	
Printing and Illustrations		40.55	
Postage		2.47	
Stationery		13.05	
Telegraph and Telephone		14.75	
Insurance (supplies including horse sprayer)		66.40	
Spraying Supplies		659.30	
Machinery, Tools and Supplies		72.37	
Express, Freight and Cartage		5.72	
Rental and Storage		340.47	
Automobiles: Insurance	$ 630.39		
Supplies and Equipment	337.98		
Repairs	747.04		
Gasoline	1,544.90		
Oil	180.21		
		3,440.52	
Heat and Light		76.34	
Inspection of Imported Nursery Stock		301.01	
Traveling Expenses		159.42	
Miscellaneous		4.36	
			$30,301.77
Balance			29,698.23
			$60,000.00

Cost of Moth Suppression Work

The gipsy moth was first found in Connecticut at Stonington in 1906. In 1909 a colony was found in Wallingford. Both of these were separate colonies and not connected with the larger infested area starting in eastern Massachusetts. By 1913, the pest had been exterminated in both Stonington and Wallingford, but in that same year the larger area of eastern Massachusetts had spread until the outer margin reached the northeast corner of the State, and egg-masses were found in the town of Thompson. Each year, therefore, since 1906, work has been done to suppress this insect, and Federal co-operation beginning in 1907 has continued down to the present time.

In the years 1911-1916, small sums were expended in scouting and destroying winter nests of the brown-tail moth, and every year since 1909, all nursery stock imported from foreign countries into Connecticut has been inspected because gipsy moth egg-clusters and brown-tail moth nests have often been brought into the United States on such importations.

The cost to the State for all of this work of suppressing the gipsy moth and the brown-tail moth, and for inspecting imported nursery stock is shown for each fiscal year in the following table:

EXPENDED BY STATE OF CONNECTICUT

Year	Amount Expended	Year	Amount Expended
1906	$1,500.00	Brought forward	$31,181.76
1907	4,550.00	1915	8,057.39
1908	2,550.00	1916	13,027.39
1909	1,503.22	1917	7,792.80
1910	4,560.22	1918	22,644.18
1911	4,017.95	1919	17,459.79
1912	2,668.97	1920	33,081.11
1913	5,231.07	1921	35,188.50
1914	4,600.33	1922	29,937.33
	$31,181.76		$198,550.25

Between the beginning of the fiscal year of 1907 and October 31, 1922, the Federal Government has expended on this work in Connecticut, including salaries, temporary labor, traveling expenses, supplies and miscellaneous charges, a total of $276,044.07. The total amount expended by both State and Federal Government on this work in Connecticut to date is as follows:

State Expenditures	$198,550.25
Federal Expenditures	276,044.07
Total	$474,594.32

INCREASED APPROPRIATION NEEDED

On account of the wind-spread mentioned on page 290, which so greatly increased the territory to be covered, a larger appropriation will be absolutely necessary for the next biennial period if the gipsy moth is held in check, and we recommend that $100,000.00 be appropriated for the two years ending June 30, 1925, instead of $60,000.00, the amount appropriated two years ago.

A request for a deficiency appropriation of $20,000.00 was placed in the budget to continue the suppression work to the end of the present fiscal period. It is estimated that a balance of about $14,000.00 will be left from the old appropriation at the time the General Assembly convenes soon after the first of January. We expected this balance to be considerably less, but the increasing difficulty in obtaining trained scouts delayed the progress of the work and consequently the expenditure of a portion of the funds during the fall months. For this reason the deficiency may be considerably less than the amount contained in the budget. Just what will be needed when the Legislature is ready

to take action on deficiencies after the present appropriation is exhausted, is difficult to state, but probably some amount between $10,000.00 and $15,000.00 will be needed.

Infestations in Other States

The gipsy moth first appeared in this country as a pest in Medford, Mass., near Boston, from which point it has spread naturally in all directions, but extending more rapidly and further toward the north than in other directions, due perhaps to climatic conditions, but chiefly to prevailing winds. Of course, its spread toward the east has been limited by the Atlantic Ocean. It has also been accidentally transported and several isolated colonies have been discovered and exterminated, particularly in Connecticut, New York, New Jersey, Pennsylvania and Ohio. The extent of the infestation now in the United States is approximately as follows:

Maine: Infested in the southwestern portion, the infestation extending along the coast into the first tier of towns in Washington County, and not further north than the center of the State. In western Maine it has spread northward into a few towns in the southern part of Oxford and Franklin Counties. The almost exclusive coniferous forests in northern Maine will probably limit the spread of the insect as a destructive pest in this direction. There is danger that it may spread eastward into New Brunswick and Nova Scotia.

New Hampshire: The entire State, except the northernmost part, Coos County, is infested.

Vermont: The insect has spread across southern Vermont to the New York line. Along the Connecticut River, there is an infested strip, four or five towns deep, extending to the northernmost county, Essex County, which has one infested town on its southern border. No gipsy moths have yet been found in the northern and western counties of Orleans, Franklin, Lamoille, Chittenden, Addison and Rutland. Washington County has one infested town and Bennington County has several. Moreover, from a knowledge of the climate and tree growth, there seems to be no reason why the insect may not continue to spread northward through Vermont and into Quebec.

Massachusetts: The entire State is now infested, thickly in the eastern portion, and scatteringly in the Berkshires, where artificial control is very difficult.

Rhode Island: The entire State is now infested.

Connecticut: All of Windham, Tolland and Hartford Counties, and all except the western portion of New London County, the northern part of Litchfield County, and two of the northern-

most towns in each of New Haven and Middlesex Counties are infested. This infestation is all scattered except in Windham County, which has been longest infested, and the northern part of Tolland County adjoining Massachusetts.

New York: A colony was discovered near Mount Kisco and one at Geneva a few years ago, and both exterminated. One on the eastern end of Long Island is nearly exterminated. Several small colonies were started at various points by being sent out on nursery stock from Somerville, N. J., but it is believed that all of these have been exterminated. During the past season the pest has been found in two or three towns adjoining Massachusetts or Vermont.

New Jersey: During the summer of 1920, an infestation of some 800,000 egg-clusters and involving about 100 square miles was found on the Duke estate at Somerville. Vigorous measures were immediately taken by State and Federal authorities, with the result that it has been nearly eradicated. Several shipments of nursery stock carried the pest to other points in New Jersey, but it is believed that these minor infestations have all been exterminated, and that the major colony will soon be exterminated.

Future Outlook

It is perfectly natural to ask about the future prospects of the gipsy moth in Connecticut. Must the State continue to make increasing appropriations to wage what seems to be a losing fight against the gipsy moth? It is a fair question. Yet this pest has been wholly eradicated from two separate infestations in Connecticut, and for ten years the invasion has been stemmed sufficiently so that no stripping of trees or noticeable injury has resulted. Were it not for the occasional wind-spreads, which cannot be prevented or foretold, the spread of the gipsy moth would be very slow in the face of the control measures in effect against it. A marked wind-spread occurred in 1915, a slight one in 1917, a greater one in 1920, but this one in the spring of 1921 is the most severe and carried the larvae the greatest distance, of any on record. With adequate funds, it is not only possible but feasible to eradicate many of these scattered infestations found the past year.

The scouting of all woodland areas is extremely expensive, and must be done several times perhaps to discover all the infestations now present. However, we may fairly expect that some of the infestations may be eradicated, and some of the towns liberated from the quarantined area.

We might take advantage of Sections 2112-2114 of the General Statutes, which provide that the towns be ordered to control

the insect within their borders. Massachusetts has a similar law, which further provides that each property owner expend a certain amount each year, based on the valuation of his property for the control of the insect on that property. If he does not do so, the town will do the work and charge it as taxes upon the property. But trained men are necessary to do this work effectively. The State has a force of such men at present. Few towns or individuals have or could obtain men trained in gipsy moth control. In such cases the work is neither efficient nor effective, and the money is not wisely expended. The moths would probably spread faster than under the present system, exclusive of the windspread.

As this insect has now spread to the borders of New York State and New Yorkers are quite alarmed over the prospect, they are seeking the best available data and advice before adopting a plan of campaign. For this purpose a conference was held at Albany, November 16, 1922, called by the New York Commissioner of Farms and Markets. With the exception of Maine, all New England States were represented, as were also New York, New Jersey, and the Canadian and United States Bureaus of Entomology. The following resolution relating to the gipsy moth was adopted:

"*Whereas,* the gipsy moth is one of the most destructive insect pests affecting forest, shade, fruit and park trees; and enormous damage has been caused by this insect in New England; and upwards of twenty millions of dollars have been expended by these states and the Federal government in their efforts at suppression and control; and,

"*Whereas,* the spread of this insect constitutes a serious menace to the forest, shade, fruit and park trees of New York State and the territory south and west thereof; and,

"*Whereas,* it has been demonstrated that in local infestations, as in the case of New Jersey, complete eradication may be possible, and that over wide areas general control measures to reduce damage and injury are practicable; and,

"*Whereas,* owing to topographic features, distribution of different kinds of trees and feeding habits of the insect, it is believed that a control zone should be established from Long Island Sound, in a general northerly course, east of the Hudson River, through New York or New England, or both, for the purpose of permanently preventing the spread of this insect; therefore,

"*Be It Resolved,* that it is the sense of this conference composed of foresters, agriculturists, entomologists and administrative officials, from the New England States, New York and New Jersey and representatives of the United States Department of Agriculture and the Dominion of Canada, held at Albany, N. Y., November 16, 1922,

"*That,* sufficient appropriation should be obtained by the states interested and the Federal government for the purpose of continuing and strengthening present control methods in the infested areas, to eradicate the New Jersey infestation, to do necessary scouting for the discovery and destruction of border infestations, to determine the location of the most practicable place for a control zone, to take necessary steps to make control therein effective, and for the destruction of all infestations in and west of said zone."

Recommendations

In view of existing conditions and our experience in work against this insect, we recommend that this suppression work be continued in Connecticut, and that Connecticut do its full share in co-operation with the other infested States and with the Federal Government in attempting to control and prevent the further spread of this destructive insect pest. To this end we recommend that the appropriation named in the budget ($100,000.00) be granted for the two years ending June 30, 1925, together with such deficiency appropriation as may seem necessary to continue the work with our regular force after the present appropriation is exhausted until July 1, 1923, when the new appropriation becomes available.

MOSQUITO CONTOL WORK

Season of 1922

By S. T. Sealy

Maintenance work for mosquito control on the marshes which have been drained was started April 3, and continued until November 1. During this time the marshes were inspected, patrolled, and all drainage systems kept open. By keeping the ditches in condition to function properly, thereby draining off surface water, salt marsh mosquito breeding was controlled to a great extent.

High tides and the abnormal amount of rainfall during the early part of the season somewhat hindered the work. The excess rain water accumulated in low places at the edge of the marshes which are usually dry. These places made conditions very favorable for mosquito development. Broods of fresh water species developed and got on the wing from a number of such places. Results of collections made during the season showed that a greater proportion of mosquitoes that were so numerous this season were fresh water species.

Several complaints from property owners and summer residents along the shore were investigated. In all investigations it was determined that the heavy mosquito invasions came either from undrained marshes in the near vicinity or from pools caused by rain water accumulating in depressions which are ordinarily dry. Another source that helped keep up the supply was furnished by cans, barrels, buckets, and other receptacles that would hold water long enough for mosquito development.

At the request of the management of Camp Everett, Twin Lakes, Connecticut, an inspection was made August 9, 1922. *Culex pipiens* was found to be breeding in a low, swampy area

extending through the camp grounds. It was suggested than a drainage ditch be dug through this area, which would carry off all surface water into the lake. It would also establish a drain for the many springs in this area. As there have been no further complaints, it is reasonable to suppose that the mosquito pest, in that particular locality, has been eliminated.

A few days before the military camp at East Haven was to be occupied by the State Guardsmen, a request was made by Major C. E. Smith to inspect the camp and determine what could be done to make it more comfortable for the men. An inspection was made July 5, 1922. Several extensive swampy areas were found to be breeding places of *Culex pipiens*. As the time was short and no funds available for drainage work, it was thought best to oil the ponds and streams near the site where tents were to be pitched.

Another inspection was made the day before the camp was to be occupied and no breeding of consequence was found. The oil and labor necessary to apply it were furnished by the military authorities.

New Haven

The marsh north of Middletown Avenue known as the "Quinnipiac Marsh" has given considerable trouble this season. The railroad company is continually increasing its yard limits, and in making foundations for new trackways, dumps carloads of fill on the meadow surface. The enormous weight causes the meadow to sink to such an extent that drainage ditches have been completely closed by the vibration that occurs when heavy trains roll over the tracks. New ditches were cut, but it was impossible to keep them in condition to function properly. In order to control mosquito breeding in this section in the future, it will be necessary to depend entirely on the use of oil until such a time as the marsh is all reclaimed by filling.

Fort Hale marsh has also been a troublesome one this season. The main outlet of the drainage system is not adequate to carry off surface water fast enough to impede mosquito development. Oil had to be used several times during the season.

West Haven

Salt marshes in the town of West Haven with the exception of the area north of Beach Street have not given any serious trouble this season. The Beach Street marsh has been flooded several times, making conditions ideal for mosquito development. The flooding was due to defective tide gates, which have needed repairs for some time past. The matter of repairs has been taken

up with the selectmen and they probably will put the gates in better shape before next season.

East Haven

The ditches on the drained marshes have been cleaned and regraded twice during the season. Mosquitoes on the wing were, however, quite numerous on several occasions. Their breeding places have been traced to the undrained marshes nearby. Another source of supply was from fresh water pools formed by abnormal rainfall.

Branford

Maintenance work has been carried on throughout the season and ditches and outlets were kept free of rubbish. A close watch was kept over the whole drainage system. Inspections of the marshes during the season did not reveal any salt marsh breeding.

Guilford

Marshes have been regularly patrolled and all ditches requiring it have been given the needed attention. The absence of salt marsh mosquitoes this season has been noticeable.

Madison

Scarcity of mosquitoes at the State Park and surrounding territory proved that the drained marshes are almost mosquito proof.

Groton

The marshes at Groton Long Point have been inspected. Ditches were cleaned and all obstructions removed. No breeding occurred on the drained areas.

Stamford

Marshes at Shippan Point have been inspected and all drainage ditches cleaned several times during the season. Heavy rainfall early in the season caused several low areas in this section to fill with water, making conditions ideal for the development of mosquitoes. Oil was used to spray these places, keeping breeding somewhat under control.

As the funds are limited for maintenance and control work, the supply of oil was not adequate to spray all breeding areas. Consequently heavy broods of mosquitoes got on the wing several times during the season.

Fairfield

Marshes in Fairfield have been regularly inspected, patrolled and kept free of mosquito breeding. The Fairfield Improvement Association has renewed its activities and carried on a fresh water mosquito campaign this season. Several breeding places have been permanently eliminated by drainage or filling and others temporarily controlled by the use of fuel oil.

Cost of Maintenance, Season of 1922

Madison	$ 293.75
Guilford	455.50
Branford	445.75
East Haven	38.00
West Haven	261.00
New Haven	515.05
Fairfield	1,245.95
Groton	36.00
Stamford	188.20
	$3,479.20

The total cost of this work for the season, exclusive of supervision, is $3,479.20, of which one-fourth, or $869.80, and the entire cost of supervision are borne by the State. The other three-fourths of the cost of maintenance, or $2,609.40, is collected from the towns by the State Comptroller.

TESTS OF SPRAYS TO CONTROL THE SAN JOSÉ SCALE

A small apple orchard at Mount Carmel, Hamden, was found to be rather badly infested with San José scale. This orchard had been somewhat neglected for a number of years, and judging from the appearance of the trees had not been sprayed. There was considerable dead wood in the tops, and the larger branches and trunks were covered with rough bark and lichens. The present owner, Mr. J. F. Corley, had recently purchased the place and wished to improve the orchard. Messrs. Zappe, Stoddard and Britton visited the orchard on March 8, and advised the owner about the pruning. The orchard was conveniently arranged to divide into six plots for various treatments. Altogether there were fifteen rows with an average of eight trees per row. The owner started to prune the orchard and was about half through with this work when it was time to make the application. Consequently where the B. T. S. (three rows) and the liquid lime-sulphur (four rows) were applied, the trees were not pruned until after the application. All other plots had two rows each.

The rows and plots extended east and west. Though the conditions in this orchard were hardly ideal for such experiments (there being too much rough bark and not enough vigor in the trees) it is difficult in Connecticut to find an orchard where the scale is sufficiently prominent for such tests. Consequently we thought it best to make them.

Mr. Walden cut twigs from each of these plots on April 11, and examined the scales to ascertain the proportions of living and dead individuals. The spraying was done by Messrs. Zappe and Stoddard on April 11, 12 and 13, an Arlington X. L. power outfit being used.

The following materials were used:

Liquid lime-sulphur, one gallon in 10 gallons of water. Four rows.

Sherwin-Williams Dry Lime-Sulphur, one pound in 10 gallons of water. Two rows.

Scalecide, one gallon in 15 gallons of water. Two rows.

Keresol, one gallon in 18 gallons of water. Two rows.

Sulco V. B., one gallon in 25 gallons of water. Two rows.

B. T. S., 12 pounds in 50 gallons of water. Three rows.

Of these commercial preparations a brief statement may be made. Keresol is an oil mixture containing about 70 per cent. of kerosene. Sulco V. B. contains fish oil and a small percentage of phenol. B. T. S. is barium tetrasulphide, a powder which is claimed to give better results than lime-sulphur. Sherwin-Williams dry lime-sulphur is purported to be of the same composition as the commercial liquid lime-sulphur, with the water left out. Scalecide and liquid lime-sulphur are both well-known and need not be explained here.

On June 7, Mr. Walden cut twigs from the sprayed plots and examined the scales to determine the effect of the treatment. The data showing the average results of each treatment is given in the following table:

RESULTS OF TREATMENT

Treatment	Percentage of scales alive before treatment	Percentage of scales alive after treatment	Percentage of scales killed by treatment
Dry lime-sulphur	20.5	5.5	74.9
Scalecide	20.7	1.6	97.2
Keresol	16.2	5.3	68.9
Sulco V. B.	20.8	2.7	84.5
B. T. S.	15.9	4.	72.6
Liquid lime-sulphur	15.1	3.1	77.3

The table shows that there was only a small proportion of the scales living at the time of the applications. On account of the rough bark it is very difficult to reach all of them in a single treat-

ment, however thorough, so in each case some were found to be living when the twigs were examined on June 7. The percentages of kill shown in the right hand column do not vary greatly, but such differences as exist show that Scalecide gave the best control (97.2) followed by Sulco V. B. (84.5). Keresol gave the lowest percentage of kill (68.9) which may possibly be due to too dilute a mixture, though the manufacturer's directions were followed. Of course the lime-sulphur mixtures and the B. T. S. do not have the penetrative power of the oil mixtures, but on young trees having smooth bark would doubtless have made a better showing. It is often necessary to give several treatments before such an orchard can be wholly freed from scale.

These trees afterward made a fairly good growth though it was evident that they needed fertilizing, cultivating and summer spraying to protect the fruit crop.

TESTS OF PARADICHLOROBENZENE AS A REMEDY FOR THE PEACH BORER

By M. P. Zappe

On September 10, 1921, a large proportion of the peach trees in the orchard at the Station Farm at Mount Carmel were treated with Paradichlorobenzene to control the peach borer, *Synanthedon exitiosa* Say. This orchard was ten years old at the time of the application and consists of five rows of trees with 30 trees in each row. A few trees have died and have been removed so that the original number were not available for experiment. Four rows were treated, and the fifth row left untreated as a check.

The material was applied according to directions given in Circular 126, New Jersey Agricultural Experiment Station, 1921. The grass and rubbish were first removed from around the trees, the soil leveled, and one ounce of the Paradichlorobenzene was sprinkled in a circular band around the base of each tree trunk about one inch from the bark. This material was then covered with soil free from grass and weeds, making a low mound around the base of the trunk.

The trees were left in this condition over winter, and examined on May 17, 1922, to note the results, which are shown in the following table:

	Number of Trees	Average No. of Living Borers Per Tree	Distribution of Average No. of Living Borers per Tree	
			Above Soil	Below Surface
Treated	108	.62	.42	.20
Untreated	22	1.95		

It will be seen from the figures in the table that the treatment reduced the average number of living borers from nearly two

borers per tree to .62, or a little more than one-half of a borer per tree on the average. Most of the living borers present in the treated trees were above the mound of soil covering the Paradichlorobenzene. Below the surface of the mound, several dead borers were found. Had the soil been mounded higher about the trunks of the trees, it is probable that few borers would have survived. Further tests are now being conducted. The trees showed no indication of injury from the treatment.

CABBAGE ROOT MAGGOT EXPERIMENTS

By M. P. Zappe

The cabbage root maggot, *Phorbia brassicae* Bouche, has caused serious damage to early cabbages nearly every year in the market gardens around New Haven. As several new methods of control have recently been recommended for this insect, it was thought best to test some of them on a small scale at the Station Farm at Mount Carmel in 1922.

Thus 296 plants of Copenhagen Market variety were set in two rows on May 11, 1922. Three treatments were applied each to 75 plants, and 71 were left untreated as checks. The following materials were used: Corrosive sublimate or mercuric chloride; tobacco dust and hydrated lime; and tarred paper disks.

Corrosive Sublimate Treatment

Corrosive sublimate (or mercuric chloride) is a poisonous chemical, partly soluble in water. It was used at the rate of one ounce in ten gallons of water, five gallons being enough to treat 75 plants, or about one-half pint per plant applied just after the plants had been set. This is perhaps more than would ordinarily be needed, but the soil was very dry and needed moisture. The other plants were given an equal quantity of clear water. A second treatment of corrosive sublimate was made about twelve days after the first treatment.

Tobacco Dust and Hydrated Lime

Tobacco dust and hydrated lime were mixed together, using equal parts by weight, and a small quantity placed around the stem of each plant as soon as set. About one and three-fourths pounds of this mixture were applied to the 75 plants. A second application was made twelve days after the first treatment.

Tarred Paper Disks

The usual hexagonal disks of tarred paper, such as may be purchased at seed stores or which may be cut from tarred paper at home, were placed on the plants when set.

TABLE SHOWING RESULTS OF TREATMENT

Treatment	No. of Plants Set	No. of Plants Killed by Maggots	Percentage of Injury
Corrosive Sublimate 1 oz. to 10 gals.	75	2	2.6
Tobacco dust, Hydrated lime Equal parts	75	7	9.3
Tarred paper Disks	75	1	1.3
Checks no Treatment	71	11	15.5
	296	21	

DISCUSSION OF RESULTS

For some unexplained reason the cabbage maggot was not very abundant, and the resulting damage was considerably less than usual on early-set cabbages at Mount Carmel. Even on the untreated plants, only 15.5 per cent. were killed by maggots. In similar experiments conducted on a much larger scale in the same locality in 1915, nearly one-third of the untreated plants were killed by maggots.

In the present tests, only one plant was killed among the tarred paper disks, two plants treated with corrosive sublimate, and seven plants died where the tobacco dust and lime were applied. Results are shown in the accompanying table.

Thus in these tests the corrosive sublimate treatment and tarred paper disks gave good control with little difference between the two. The former is cheaper and easier to apply. It takes more time to apply the disks to the plants and their cost is greater than that of the corrosive sublimate material, which may be purchased for thirty cents an ounce in small quantities. In larger quantities the cost would be considerably less. An ounce proved enough to treat 150 plants, or to give two applications to the 75 plants in the test. On the other hand, corrosive sublimate is a dangerous poison, and many would prefer to use the tarred paper disks, especially in the home garden.

WORK WITH THE EUROPEAN RED MITE[1] IN 1922

By PHILIP GARMAN

The European red mite appeared in Connecticut orchards early in the season, multiplied abundantly and rapidly, and by the middle of June had caused considerable foliage injury. Heavy rains

[1] *Paratetranychus pilosus* Can. and Fanz.

then set in and continued until late in the summer, resulting in only a slight increase of the mites, or in most cases a decided decrease in relative numbers. With these weather conditions it is evident that early treatments should prove of more value than later ones and, as will be seen, they were actually of more benefit.

Eggs began to hatch in 1922 about May 2. A few mites were found mating on May 13 and freshly laid eggs were seen May 15. Eggs laid May 16 and 18 then hatched May 29, but the mites were not followed to maturity at this time. However, eggs hatching July 1 matured by July 8 and the preoviposition period appeared to be of about two days duration. Eggs laid August 6 hatched August 14 and matured August 23. Eggs obtained from another adult August 29 hatched in eight days, while eggs laid September 15 failed to hatch and were apparently in condition to pass the winter. Thus we see that there is a relatively short life cycle, consisting of approximately seventeen days in August, though requiring longer in cold weather. The adults were kept alive in June for three weeks, and one individual laid 34 eggs during this time. It also appears that approximately half the life period is passed as an egg, which in mid summer may remain a week before hatching. Sprays not affecting the egg should therefore be repeated within ten days (allowing eight days for the mites to mature and two days before egg-laying begins), but if more sprays are applied, the third should not necessarily follow within this interval, but could be delayed from two weeks to eighteen days without loss in efficiency.

Spraying operations were undertaken during the summer in three different orchards as follows: (1) the Bradley orchard, owned by Mr. S. T. Bradley at North Branford; (2) the orchard owned by the Plant Brothers at Branford, and (3) that owned by Mr. F. N. Platt at Milford. To all of these gentlemen thanks are due for valuable help and co-operation.

The Bradley orchard consists of Baldwin trees, set in rows, the trees 16 feet apart in each row. This condition provides excellent quarters for mites, and a serious infestation appeared early in June. The orchard received no winter treatment except a few rows through the center which were, however, disregarded, and no special mite treatment applied. It was learned from Mr. Bradley that the whole orchard had been sprayed at the pink bud period with lime-sulphur, lead arsenate and nicotine, and had received one other spray with this combination. Plots were laid out consisting of three rows and 8 to 12 trees deep. The spray outfit consisted of a four-cylinder power rig furnishing a pressure of 300 to 400 pounds. Two leads of hose were used with a spray gun on each.

Each plot received two treatments, one being applied June 2 and the other June 16. The following sprays were used and there was no variation in the two treatments in the composition of the spray: (1) linseed oil emulsion[1] composed of 1 gallon of linseed oil and 1½ pounds of Ivory soap flakes to each 100 gallons of water; (2) Ivory soap flakes, 3 pounds to each 100 gallons of water; (3) Kerospray, 1 gallon to each 100 gallons of water; (4) fish oil soap (sodium) 8½ pounds to 100 gallons; (5) self-boiled lime-sulphur 8-8-50 formula with 1½ pounds of casein lime spreader per 100 gallons; and (6) checks consisting of trees not receiving any treatment, especially for mite control, the only sprays being those applied early in the season by the owner, as mentioned above. Count twigs were collected from trees in the center of the treated blocks after the first spray, but it soon became evident that the value of the sprays (excepting self-boiled lime-sulphur) could be easily judged by inspection, those with fewest mites having decidedly greener foliage.

Examination June 5 showed the block treated with linseed oil to be in somewhat better condition than the rest, but that treated with fish oil soap was not far behind. There was little choice in the remaining treatments except for the Kerospray treatment, where the trees equaled the checks in brownness of foliage. Results of the count are seen in the following table:

RESULTS OF FIELD TESTS WITH SOAPS, LINSEED OIL EMULSION AND SELF-BOILED LIME-SULPHUR

In Bradley Orchard

Insecticide Used.	No. Alive	No. Dead	% Dead	No. of Leaves Examined	No. of Twigs Examined	Date of Treatment	Date of Examination 1922
Linseed Oil 1 gal. Ivory soap 1½ lbs. Water 100 gals.	718	1,524	67.9	80	10	June 2	June 6
Ivory soap 6 lbs. Water 200 gals.	1,743	779	30.8	60	9	June 2	June 6
"Kerospray" 1 gal.-100 gals.	916	381	29.5	50	6	June 2	June 6
Fish oil soap 14 lbs.-200 gals.	691	655	48.6	54	6	June 2	June 7
Self-boiled lime-sulphur (8-8-50) Kayso 2½ lbs.-200 gals.	951	356	27.2	64	8	June 2	June 8
None	1,592	278	14.	65	7	———	June 8

[1] Prepared according to directions in Mass. Agr. Exp. Sta. Bull. 179, pages 175-6, except that flakes were used instead of bars of soap.

Inspections were made June 20, June 30, August 2 and October 8. The same relative value of the treatments was apparent up until the last inspection, those trees treated with fish oil soap and linseed oil emulsion having much better and greener foliage and more of it, as shown on Plate IX, photographed October 8. However, none of the fruit appeared to be in good condition at the end of the season, being largely deformed by aphis and affected with Brooks' fruit spot. Other ingredients are needed to make the spray practical.

The linseed oil and fish oil soap sprays were repeated at Plant's orchard at Branford, the sprays being applied June 26 and July 11. Here the material was applied by power outfit and spray rods. The water used was comparatively hard and the amount of Ivory soap used to emulsify the linseed oil was increased to 2½ pounds of flakes to each 100 gallons after the first application. Fish oil soap was used at the rate of 7 pounds per 100 gallons. The orchard had received a delayed dormant spray with lime-sulphur, a "pink bud", "calyx" and "two weeks" sprays with the usual mixtures. The most heavily infested trees were York Imperials and these were treated with linseed oil emulsion.

While there was no marked improvement in treated trees over checks in this orchard, there appeared some slight improvement in the condition of the foliage, which continued to the end of the season. However, on inspection October 8, little difference could be seen between checks and trees treated with the above mixtures.

The experiments in the orchard of Mr. F. N. Platt at Milford consisted of three treatments, two of which were given in connection with dusting and spraying experiments conducted by Messrs. M. P. Zappe and E. M. Stoddard of this Station. The first consisted of a block of Baldwin and Greening trees, 25 trees in all, 15 of which were Baldwins. These were treated with a combination of borax laundry soap and flour of sulphur. The first application contained four pounds of soap and 10 pounds of sulphur to each 100 gallons, the second seven pounds of soap and 15 pounds of sulphur, and the third six pounds of soap and 10 pounds of sulphur per 100 gallons. Applications were made May 13 (calyx), June 13, and July 19.

The second block, 56 trees, was treated with lime-sulphur and lead arsenate plus nicotine sulphate at the "pink bud", "calyx cup", and "two weeks" periods, these sprays being applied April 27, May 19 and June 13. Two additional applications, June 29 and July 19, were made, but apparently did not increase the efficiency of the control. On the same dates (April 27, May 19, June 13 and 29, and July 19) a third block was dusted with 90-10 sulphur dust containing nearly 4 per cent. nicotine. All sprays were applied with a spray gun, with a single lead of hose and power rig

furnishing about 200 pounds pressure; the dusts with a power duster. The entire orchard received no winter or dormant spray.

Inspection of all sprayed trees (both soap and lime-sulphur treatments) in the latter part of June, showed a good many live mites, but the foliage did not turn brown and the fruit appeared to be in good condition at this time. Some of the check Baldwin trees, however, showed considerable browning and defoliation at the end of the season. The block sprayed with lime-sulphur, etc., and that dusted with sulphur and nicotine were adjacent, and the difference in their appearance was very noticeable in the Baldwins. Those sprayed with lime-sulphur, nicotine sulphate and lead arsenate, were green and healthy in appearance, while those dusted with sulphur and nicotine soon turned brown in color, so that a distinct line could be seen between the two blocks. In other words good control was obtained with the sprays and practically none with the dusts. The dusted trees lost considerable foliage towards the end of the summer and appeared in about the same condition as some of the check trees in other parts of the orchard.

As a general summary, then, it may be stated that fish oil soap, laundry soap plus sulphur, linseed oil emulsion and lime-sulphur with lead arsenate and nicotine sulphate gave control in 1922, the more effective being applied before the middle of June. Dust containing nicotine, lead arsenate and sulphur did not control the mite effectively. The mite hatched about May 2 in 1922, and these matured about the middle of this month. In July approximately two generations were observed; and winter eggs were found September 15.

The relative cost of the successful sprays are seen below. It will be noticed that fish oil soap is cheaper than any of the others, and substances could be added for control of fungous diseases without making it too expensive. Linseed oil emulsion is a close second to fish oil soap in this respect, but we do not regard it as a safe practice to add arsenates to either of these sprays, and additional treatments are necessary to control chewing insects. It is not necessary to add nicotine sulphate to fish oil soap, though its addition would doubtless help in controlling aphis. In regard to combinations with linseed oil emulsion, not much is known though it is probable that arsenates, if added, would cause foliage injury.

Cost of Successful Sprays, per 100 Gallons

Lime-sulphur-nicotine-sulphate-lead arsenate ...	$3.00 to $5.20
Fish oil soap	.70 to 1.40
Laundry soap plus sulphur	1.72 to 2.32
Linseed oil emulsion	1.50 to 1.80

A few tests were made for control of the mites, the results of which are found in the following table:

RESULTS OF TESTS TO CONTROL MITES

	Insecticide Used	No. Dead	No. Alive	% Dead	Temp. of Atmosphere	Date	Stages Observed
1.	Ivory soap flakes 2 lbs.-50 gals.	67	12	84.8		May 20–22	Mostly adults
2.	Ivory soap 2 lbs.-50 gals. plus Melrosine 1 part-100	71	14	83.5		May 20–22	Mostly adults
3.	Ivory soap flakes 2 lbs.-50 gals.	409	2	99.5	23° C.	May 13–18	Adults and quiescent nymphs
4.	Ivory soap flakes 2 lbs.-50 gals.	406	4	99.0	27–28° C.	May 13–18	Nymphs
5.	Lux 2 lbs.-50 gals.	107	1	99.0	23° C.	May 13–18	Nymphs
6.	Lux, 2 lbs.-50 gals.	164	3	98.1	27–28° C.	May 13–18	Nymphs
7.	Dusted with sulphur	22	59	27.1	23° C.	May 12–18	Nymphs
8.	Dusted with sulphur	101	2	98.0	27–28° C.	May 12–18	Nymphs
9.	Check, no treatment	4	53	9.5	23° C.	May 12–18	Nymphs
10.	Check, no treatment	22	31	41.7	27–28° C.	May 12–18	Nymphs
11.	Check, no treatment	12	70	14.6		May 20–22	Mostly adults
12.	Fish oil soap (potassium) 10 lbs.-50 gals.	12	14	46.1		May 23–25	Adults only
13.	Fish oil soap 5 lbs.-50 gals.	13	41	24.0		May 23–25	Adults only
14.	Check	1	25	3.4		May 23–25	Adults only
15.	Fish oil soap 10 lbs.-50; sulphur 16 lbs.-50 gals.	16	93	14.6	27–28° C.	May 27–31	All stages
16.	Ace Hy 1-400	108	254	29.8		June 31–July 1	All stages
17.	Ace Hy 1-200	40	[illegible]	95.2		Aug. 29	All stages
18.	Check	30	287	9.4		Aug. 29	All stages

THE OCCURRENCE OF SEVERAL NEW SPIDER MITES IN CONNECTICUT

By PHILIP GARMAN

Discovery of the European red mite, *Paratetranychus pilosus* (Can. and Fanz.) in Connecticut in 1920, led to the belief that the mite fauna of this State is more cosmopolitan than many groups of insects, a belief which has been verified by the discovery of several new forms of economic importance not hitherto known to occur in Connecticut, some of them not yet reported from the United States. Our attention has been called a number of times to the injury caused by the spruce mite, *P. ununguis* (Jacobi), which on investigation appears to be well distributed over the State. Similarly *Paratetranychus bicolor* Banks, fre-

quenting oaks, chestnut, etc., is well distributed and fairly common. All in all, six species have been found which appear worthy of consideration at this time.

Tenuipalpus lineola (Can. & Fanz.)[1]

This mite has been found feeding upon the under surface of the leaves of elder, *Sambucus canadensis* Linn. It is very inconspicuous and seems to lack the bright color which it has further south. McGregor[2] states that it injures privet in South Carolina, completely defoliating them in some cases. He recommends the use of Schnarrs' Insecticide or lime-sulphur for its control.

Tetranychus populi (C. L. Koch)[1]

This mite infests poplar, being found on the under surface of the leaves. As the species is new to this country, the possibility of its becoming injurious is unknown at present. In England it

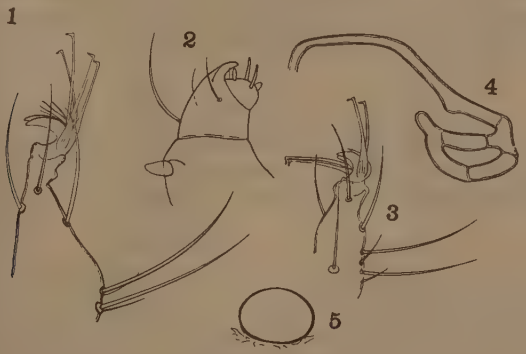


Figure 6. *Tetranychus populi* (C. L. Koch). 1. Tarsal claw of the first pair of legs of female. 2. Palpus of male. 3. Tarsal claw of the first pair of legs of male. 4. Collar tracheae of female. 5. Egg. All greatly enlarged.

is recorded from Lombardy poplar, and is found in Italy on the same host. It is apparently the same as *T. salicicola* Zacher, which infests willows and poplars in Germany. Structural characters of this mite are shown in Fig. 6.

Schizotetranychus schizopus Zacher[1]

This species has been found on various willows in Connecticut, but it is probably not capable of doing serious damage. It was

[1] Identified by Dr. H. E. Ewing.
[2] This species is the same as *T. bioculatus* McGregor.

found in nursery plantings at Wallingford, and also upon native species in the town of Hamden. It is reported from Pennsylvania by Stear (Jour. Ec. Ent. 16:96:1923). Structures are shown in Fig. 7.

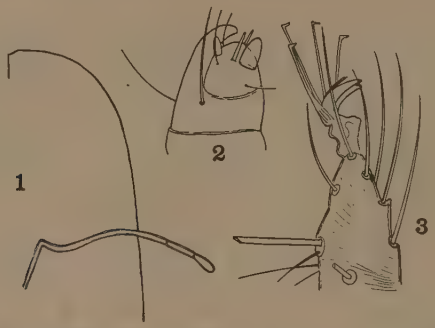


Figure 7. *Schizotetranychus schizopus* Zacher. 1. Collar tracheae of male. 2. Palpus of male. 3. Tarsal claw of first pair of legs of female. All greatly enlarged.

Paratetranychus bicolor Banks

This mite infests oak most commonly, but is also found on chestnut and birch. Unlike most other species it feeds mainly upon the upper surface of the leaves, especially along the mid-rib.

Oligonychus americanus Ewing[1]

This species determined by Ewing has been reported as causing severe injury to spruce and evergreens in Canada. Its presence in Connecticut had not been recognized prior to its determination in 1922, being considered identical with *P. ununguis* (Jacobi). It is apparently able to do considerable damage.

NOTES ON THE LIFE HISTORY OF THE SPRUCE MITE

Paratetranychus ununguis (Jacobi)

By Philip Garman

This mite has been observed on spruce, red pine seedlings and cedars in Connecticut, and is capable of doing much harm, especially to young trees. The attacks cause the needles to turn brown and drop off. The mites spin a copious web (Plate X, b) within

[1] Identified by Dr. H. E. Ewing.

which they feed, and, like *pilosus,* they multiply most rapidly in spring, the greatest damage being done to young growing needles.

The life history of the mite was studied, and the following notes are offered for what they are worth. The winter is passed in the egg, which is laid on the twigs, usually at the base of the needles. They hatched about April 25 in 1922, and mites infested the trees until fall, winter eggs being deposited about October 1.

The newly hatched larva is very light in color, but soon turns dark green, and successive stages are also dark green to almost black. The adult female has a narrow pale streak on the mid-dorsum and a pale collar. The structure of the tarsi, etc., are illustrated in Fig. 8. The egg has a central stalk and faint radiating ridges above, and when first laid it is clear, light brown, but darkens with age. The incubation period varies from five days at 80-90° F., to 13 days at 62° F., averaging about 11 days

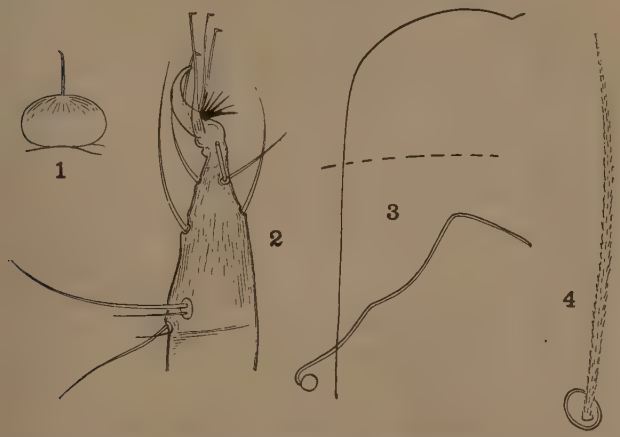


Figure 8. The spruce mite, *Paratetranychus ununguis* Jacobi. 1. Egg. 2. Tarsal claw and appendages of the first pair of legs of female. 3. Collar tracheae of female. 4. Dorsal seta of female. All greatly enlarged.

at 70°. The remainder of the life period (larva to adult) requires about five days at 80-90° or 13 days at 62.7°. At 69° the period lasted nine days. There is a preoviposition period of from one to four days. A total period (from egg to adult) of 11 to 23 days was obtained, the shortest period under natural conditions being 14 days. There are apparently three molts in both sexes, each molt being preceded by a quiescent period of one to three days. Adult females were kept alive from six to eight days in confinement, but probably live much longer under natural conditions.

The mites were reared in small tubes fastened on the needles as shown on Plate X, a, one end of the tube being plugged with cotton, the other fastened on the twig with a cotton plug soaked in beeswax. These tubes furnished suitable conditions for the development of the mites and continuous generations were obtained in some of them.

The tables below give the life history data in tabular form:

TABLE SHOWING LENGTH OF THE EGG STAGE AT NEW HAVEN IN 1922

Eggs Obtained	Eggs Hatched	Number Observed	Length of Period, Days	Mean Temperature Degrees Fahrenheit
May 19	June 1	3	13	62.5
June 21	29	2	8	
21	30	2	9	
23	30	1	7	
July 17	July 24	1	7	
11	15	1	5	
11	20	1	9	
11	18	1	7	
11	19	2	8	
13	20	1	7	
Aug. 3	Aug. 11	6	8	
5	13	1	8	
25	30	3	5	80–89[1]
4	13	1	9	
4	14	1	10	
6	13	2	7	
6	14	1	8	
17	22	2	5	
18	29	1	11	70
19	29	1	10	69.4
19	30	1	11	69.2
18	29	2	11	70
18	30	1	11	69.9
Sept. 6	Sept. 16	2	10	69.4
9	21	1	12	66.0
Aug. 29	4	2	6	80–89[1]

TABLE SHOWING LENGTH OF LIFE CYCLE

Eggs Obtained	Eggs Hatched	Adults Obtained		Eggs Obtained From Adults	Total Period, Days	Mean Temperature Degrees Fahrenheit
June 23		July 10		July 14	21	68.1
23	June 30	5			12	67.5
21	30	8		10	19	68.1
Aug. 3	Aug. 11	Aug. 19	(Male)		16	71.3
3	11	18		20	17	71.4
4	13	17			13	70.5
19	29	Sept. 7		Sept. 9	21	69.2
19	29	7		9	21	69.2
19	29	7	(Male)		19	69.7
18	29	8		10	23	68.9
29	Sept. 4	8		9	11	80–90
	15	28	(Male)		13	62.7

[1] Reared in an incubator.

DOES THE CORN EAR WORM LIVE OVER WINTER IN CONNECTICUT?

Chloridea obsoleta Fabr.

The corn ear worm which was so very abundant in Connecticut in 1921 (see Report of this Station for 1921, page 165) was present in small numbers in 1922, but was reported or sent to the Station from only a few places. Mr. Zappe found it in Hamden and New Haven, and County Agent B. G. Southwick reported it as being "rather numerous in Hartford County, though not so bad as last year." Mr. L. J. Robertson, Manchester, informed the writer that his corn was quite badly infested by it in 1922, and that he did not see it at all in 1921.

In the fall of 1921, much material of this insect was sent to the Station, and an additional quantity was gathered by Mr. Zappe at the Station Farm, and from his own garden. On October 24, this collected material was placed in two cages each having fifteen larvae with nubbins of corn, and these cages were placed out of doors. One cage had an open bottom and was placed upon the ground so that the larvae could enter the ground and have the ground moisture and temperature. The other cage was sunken in the ground, but being of metal no predaceous insects or other animals could reach the larvae or pupae. Both cages were covered with wire netting. The material sent in by correspondents was placed in the cages in the insectary connected with the laboratory, and which is heated barely enough to keep the temperature just above freezing.

The larvae entered the soil and pupated in the usual manner, and we expected to rear some adults the following season, especially from the cage in the partially heated insectary. No adults or parasites were obtained in 1922 from any of the cages. Some dead pupa shells were found in the cage in the inside insectary, but no remains could be found in either of the cages outside.

This experience cannot be taken as proof, but it indicates that this insect may not be able to survive the winters in this latitude. We hope to make further tests on this point. As was mentioned in the Report of this Station for 1921, some entomologists believe that our invasions of the corn ear worm late in the fall, especially in the northern states and Canada, may be due to a flight of moths from the southern states. There is also a possibility that they may be due to infested sweet corn shipped north in mid-summer.

Several times the writer has seen southern grown sweet corn on sale in markets before the local crop is grown, and the southern product often is infested with these larvae, one or more of which are eating the soft kernels at the tip of the ear.

larvae at the base of cane plants, but mistook them for the Japanese beetle of Hawaii (*Adoretus tenuimaculatus* Waterh.). In 1912, Dr. A. T. Speare, in studying the fungous diseases of insects affecting sugar cane in Hawaii, collected a number of these larvae and turned them over to Mr. F. Muir, who recognized them as a species new to the islands. In June of that year, Mr. Muir visited the infested fields and collected adults. The pest, though infesting but a small area, was extremely destructive, and the Hawaiian Sugar Planters' Association detailed a specialist to proceed to the Orient and obtain parasites for the control of this pest. This work was so successful that one of the parasites (*Scolia manilae* Ashm.) was established between the years of 1914 and 1916, and by 1919 it had so thoroughly controlled this pest that from an area where, in 1917, 3,500 *Anomala* grubs were collected only four grubs were found, by most diligent search. The parasite has extended its range beyond the area infested by the *Anomala,* and is now infesting the Japanese beetle of Hawaii. That the *Anomala* is established in Connecticut seems evident, as specimens have been collected in the same nursery two successive years."

I corresponded further regarding the matter with Mr. J. A. Hyslop, Editor of the Insect Pest Survey Bulletin, and placed all the facts before the Federal Horticultural Board. Mr. Zappe visited the spot two or three times during July and August, 1922, and made a careful search for more adults. None could be found.

The precise locality where these beetles were collected was a part of a nursery, but the land had been sold recently for building purposes, and new houses now occupy every available site. The nursery stock was all removed, and the excavations and grading necessitated the handling over of all the surface soil, so that it is quite probable that the infestation may have been entirely eradicated. Nevertheless, a careful watch will be kept, and if further signs of this insect appear, attempts will be made to eradicate it.

NICOTINE DUST AS A CONTROL FOR THE TURNIP APHID

By B. H. Walden

On August 21 a field of yellow Rutabaga or Swedish turnips at the Station Farm was found infested with the turnip aphid, *Aphis pseudobrassicae* Davis. The leaves on a few scattering plants throughout the field were turning yellow from injury, and a large proportion of the other plants had colonies of aphids on the under side of the leaves. The indications were that the crop

would be severely injured if no treatment were applied to control the aphids.

The turnips were planted in rather close rows and the tops covered about three-fourths of the surface of the ground. It was evident that it would not be practicable to spray the field, and it was decided to use a nicotine dust and apply it with a hand duster.

The application was made on the evening of August 21, using a sulphur-nicotine dust containing five per cent. of nicotine sulphate, equivalent to two per cent. of nicotine.

It was found that by placing the discharge pipe of the duster near the ground it was possible to cover thoroughly the underside of the leaves with the dust.

An examination of the field two days later showed that the aphids were practically all killed where the dust was thoroughly applied. On the far side of the field where the dusting was finished as it began to grow dark, some of the aphids were not killed. This side of the field was dusted again on August 26. A satisfactory crop of turnips, which, without any treatment, would probably have been a failure was produced on the field. No record was kept of the cost of the treatment.

According to Campbell*, one man with a bellows type of hand duster can cover about two acres of truck crops per day, and from 30 to 50 pounds of dust is required, depending upon the size of the plants to be treated. With nicotine dust at twenty cents per pound and labor at three dollars fifty cents per day, the cost of treating an acre would be from seven dollars seventy-five cents to eleven dollars seventy-five cents.

THE RHODODENDRON BORER

Sesia rhododendri Beutenmuller.

During the last two years damage to rhododendron plantings from a borer has been reported from New Haven, South Manchester and Greenwich. In most cases *Rhododendron maximum* was the species attacked or damaged more seriously than others, but in a number of instances hybrid rhododendrons were injured. The damage is caused by a larva tunneling in the sap wood and inner bark, usually on the larger stems and especially at a crotch. This injury cuts away a portion of the cambium and causes a partial or complete girdling of the twig or branch. The burrow of each larva is more or less irregular in shape. It is often on the upper side of a branch, or on the inside of a crotch, but usually is just below the crotch. Sometimes, however, several larvae tun-

* Nicotine Dust for Control of Crop Insects, Farmers' Bulletin 1282.

Though the results of the tests here reported are only negative, they support the theory that the species does not survive our northern winters, but further work is necessary to settle the matter.

NOTES ON THE EGG STAGE OF THE EUONYMUS SCALE

In preparing the article on the Euonymus scale published in the Report of this Station for 1921, page 185, the question arose regarding the stage in which this insect passes the winter. Houser[1] states that "the winter is passed in the egg stage, securely protected by the rigid scale of the mother insect. From these over-wintering eggs young emerge in late May or in June, and two broods at least develop during the summer."

On September 15, 1921, specimens received at the Station showed on examination that the eggs had not been formed. On October 27, Dr. Garman collected material and examined it in the laboratory. There were living females under the shells, but no eggs. I collected more material and placed in the insectary on November 22. Dr. Garman examined specimens on this date and found no eggs.

Some of our species of *Chionaspis* form eggs under the shells early in the fall, at least as early as the middle of September, and pass the winter in the egg stage, the eggs hatching the last few days of May. Therefore we were interested to learn the truth in regard to this point in the life history of the Euonymus scale. Other problems demanded our attention most of the time, but Mr. Walden examined the scales from time to time during the winter without finding eggs. I quote from his notes as follows: "On May 5, eggs had formed in the bodies of some of the scales. They were slightly lighter, but of the same color as the bodies of the females. The shell was thin and frail and the contents of a watery nature. On May 11, there were from three to seven eggs under a number of the shells, and the tip of the abdomen in these scales was somewhat contracted, but all still contained eggs. On May 18, some of the eggs had hatched. Under many of the shells, there were at the same time, eggs within the female, eggs which had been ejected, and others which had hatched.

Description of Egg: Length, .2 mm., width, .08 mm., cylindrical with ends rounded, the surface smooth and shining, and the color a dark amber."

Thus these observations confirm those made at Washington, D. C., by the late Dr. C. V. Riley[2] called to my attention by Mr.

[1] Bulletin 332, Ohio Agricultural Experiment Station, page 293, 1918.
[2] Proceedings Entomological Society of Washington, iii, 66, 1893.

Harold Morrison to the effect that the Euonymus scale winters as a partially mature female, and that the eggs begin to be formed during May. Dr. Riley makes no mention of the color of the eggs, but states that the females continue to produce eggs over quite a long period.

We may therefore regard it as settled that this insect in Connecticut at least forms eggs in May, and passes the winter as partially grown females. We were unable to follow the species through the season to learn whether it is single-brooded or double-brooded in Connecticut.

AN ASIATIC BEETLE IN CONNECTICUT

Anomala orientalis Waterhouse

On July 16 and 29, 1920, and July 26, 1921, Messrs. Zappe and Walden collected a few beetles in Westville, New Haven, on the grounds formerly occupied by the Elm City Nursery Company, but now covered with new dwelling houses. These beetles were recognized as belonging to the genus *Anomala,* but were distinct from the species represented in the collection, and from any that we had seen. Specimens were sent to Mr. Charles Schaeffer of Brooklyn, who, at that time, was engaged in making a study of the American species of *Anomala.* Mr. Schaeffer was unable to identify the species, but considered it a possible introduction, and finally sent it with other Coleoptera to Mr. Arrow of the British Museum for identification. On May 17, 1922, I received from Mr. Schaeffer a letter containing the following: "He identified it as *A. orientalis* Wat., a Japanese species, he tells me, which is reported as a destructive pest on sugar cane in the Hawaiian Islands. If it should get a good foothold here it may prove as injurious as *Popillia japonica* (the Japanese beetle) in New Jersey, also an introduced Japanese species." This beetle is shown on Plate XIV, b.

A few days later, I sent this information, together with reports on other insect pests, to the Federal Bureau of Entomology for the Insect Pest Survey, and the Insect Pest Survey Bulletin of June 1, 1922, contained the following note: "One of the most interesting developments of the month has been the determination of a beetle, collected in a Connecticut nursery during the past two years, as *Anomala orientalis* Waterh., the *Anomala* which occasioned so much concern in Hawaii about 10 years ago. The insect is a native of Japan, and was probably introduced into Hawaii before 1908 in soil on the roots of imported plants from Japan. In 1908, Dr. Lyon, then working with the Hawaiian Sugar Planters' Association, observed large numbers of these

nel in the same stem and girdle it. The injury is usually, though not always, apparent from the outside of a planting, on account of the leaves scorching or turning brown at the edges and often the branch breaks off. An injured stem is shown on Plate XV.

Mr. Zappe was the first member of the Department to inspect an injured plantation. This was on St. Ronan Street in New Haven, and the examination was made on March 25, 1922. He found the borers numerous in the stems just below the point where the main stems branch, and considerable injury had already been done to the planting. He collected some material from which the adults emerged on the 16, 20 and 26 of May.

On March 31, we received some rhododendron stems with white larvae in tunnels in the sap wood from Mr. C. C. Gallinat, gardener for the F. W. Cheney Estate at South Manchester. Mr. Gallinat wrote that these insects had destroyed a good many whole plants, and that there were also many bushes with borers in them. Mr. Zappe and the Entomologist visited the grounds on April 26, and found the borers in many plants of *Rhododendron maximum*, and also in a few hybrid rhododendron plants. There were many dead tops and broken branches. From material collected on this trip, adults emerged on June 6.

On April 29, the Entomologist visted Keney Park, Hartford, and in company with Mr. George H. Hollister, Superintendent, examined a portion of the extensive plantings of *Rhododendron maximum* there. This evergreen shrub is planted there in large masses, and a majority of the stems showed injury from the attacks of the rhododendron borer. From many of the infested stems, the bark had been torn off in shreds, apparently by birds, and some of the larvae had been eaten. According to Dr. Felt[2] the downy woodpecker feeds upon the larvae, often inflicting deep wounds, which may cause more injury than the attacks of the insect.

On May 10, Messrs. Garman, Zappe and Britton, in company with Mr. F. A. Bartlett of Stamford, visited the grounds of Mrs. Williams near Edgwood Inn, Greenwich. Large masses of rhododendrons had been injured by the borers, and the gardener had cut them out, covered the wounds with grafting wax and wrapped the stems with newspapers. In fact he had done this work so thoroughly that it was difficult to find a borer in any of the stems. On the same day, May 10, Mr. Zappe noticed the characteristic injury on rhododendrons growing near the sidewalk on the grounds of Miss Anna B. Jennings in Fairfield, but he did not enter the premises to ascertain the extent of the infestation.

In June 1920 we received from the Elm City Nursery Company

[2] See references to literature at the end of this paper.

of New Haven, a section of *Rhododendron* stem, from which the adult moth emerged on June 23.

The insect responsible for this injury is one of the clear-wing moths, *Sesia rhododendri* Beutenmuller, presumably a native of the United States, as it was originally described from Pennsylvania in 1909.[1]

Life History

The complete life history has not been worked out in Connecticut, but the account given by Dr. Felt[2], from Mr. Engelhardt's notes, indicates that the eggs are laid singly on small twigs, though many of them may occur in close proximity to the trunks and branches of large plants. On hatching, the larva at first attacks the inner bark, tunneling through the cambium layer into the sap wood, where it forms irregular galleries from one to two inches in length. The larva becomes about half-grown by the latter part of August, and many reach full size by the end of October. Each larva remains in its gallery in a dormant condition throughout the winter, and in early spring prepares a place to pupate by burrowing outward from the hibernating chamber through the outer bark, leaving only a thin circular layer at the opening for the easy emergence of the adult. Pupation takes place in May in the lower gallery in a loose cocoon made of silk and small bits of wood, the pupal stage requiring about fifteen days. In 1922 our specimens emerged as adults from May 16 to June 6.

According to Mr. Englehardt's observations, young plants and small twigs are often girdled and soon wilt and die. Larger stems are more resistant, but as the insect prefers to work in and around the wounds caused by previous attacks, the injury is cumulative and finally kills the stem or plant. Dr. Felt states[2] that plants are rarely injured within one foot of the ground, but occasionally we find stems with borers working near the base. According to the observations of Mr. Engelhardt, mountain laurel and azalea are also attacked only when grown with rhododendrons.

Natural Enemies

According to Dr. Felt[2], one Hymenopterous parasite, apparently a species of *Macrocentrus*, has been reared from the infested branches. The downy woodpecker also destroys many of the larvae, and evidence of the work of woodpeckers was present in the infested rhododendron plantings in Keney Park, Hartford, examined by the writer on April 29, 1922.

Descriptions.

Egg: Length .45-.53 mm; thickness .29-.32 mm; white, oblong, somewhat flattened on two opposite sides. Finely and indistinctly reticulated and closely resembles the egg of the peach borer. Shown in figure 9, e.

Larva: Length about 10 mm; thickness about 2 mm; body yellowish-white, semi-transparent, cervical shield and caudal segment slightly darker, transparent, the latter bearing brownish hairs. Head and legs reddish-brown, mandibles a darker brown. Each body segment bears a number of rather short, stout brownish hairs. Shown on plate XV, a, and in Figure 9, a.

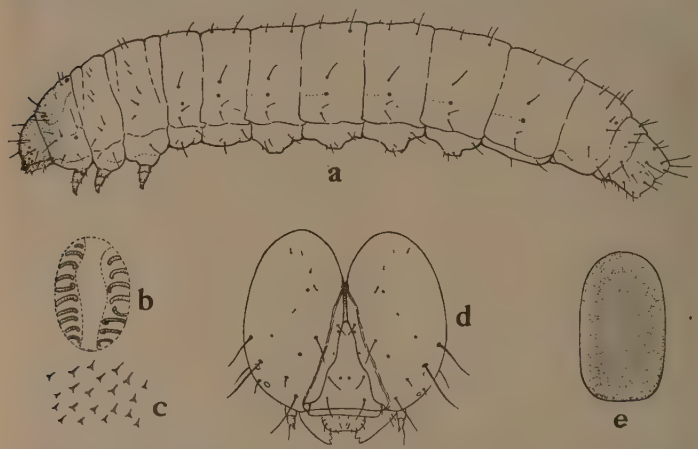


Figure 9. The rhododendron borer, *Sesia rhododendri* Beutenmuller. a. Larva, about thirteen times enlarged. b. Hooks of prolegs, greatly enlarged. c. Microscopic appearance of cuticle. d. Front view of head, greatly enlarged. e. Egg, about fifty times enlarged.

Adult: The following is the original description by Mr. Beutenmuller:

"Male: Head black with metallic blue black reflection, and a few white scales on each side of the face. Palpi yellow beneath, black above. Collar metallic black above, white at the sides and beneath. Antennae purple. Thorax wholly purplish or bluish metallic black. Abdomen metallic black, with a narrow yellow transverse band on the posterior edges of the second, fourth and fifth segments, and a yellow line on each side from the base to the first yellow band. Anal tuft large black, narrowly edged with yellow at the sides and yellow along the middle beneath. Thorax beneath black, with a yellow patch on each side. Abdomen beneath black, with the yellow bands on the fourth and fifth segments very broad or almost covering the segments. Legs: Anterior coxae white, slightly marked with yellow, femora purplish or bluish, yellow on the inner sides. Middle and hind

tibiae metallic purple, with the spurs and tufts pale yellow. Tarsi pale yellow, scaled with black above. Wings transparent, narrowly bordered with purple along the costa inner margin and broadly margined with the same color along the outer margin. Borders with a few yellow scales. Transverse mark purple, as are also the veins. Hind wings transparent, narrowly bordered with a black, which appears brassy in certain lights. Underside of fore wings with the borders golden yellow, with the veins and transverse mark like above. Expanse 10-15 mm.

Female: Very similar to the male in color and markings, but the transverse bands on the abdomen are broader and cover segments beneath. Sometimes these bands are whitish at the middle beneath."

The adult is shown on Plate XV, b.

Control

The problem of control is a somewhat difficult one in large plantings. In small plantings it may be possible to examine every stem and to cut out the borers, but even this is quite a task. The wounds caused by the borers and in cutting them out should be protected from further attack and also from decay. Covering them with grafting wax, as was done in Greenwich is probably a satisfactory treatment, though perhaps coating the wounds with melted paraffin would be simpler and easier, applying it with a brush. All dead or badly infested stems and branches should be removed and burned during the fall, winter or early spring. Mr. Engelhardt[2] suggests scraping the injured portions, then applying thick tar paint, one coat "in the fall as a repellent to woodpeckers, and another in the spring preferably in late April or early May to prevent the emergence of the moths."

Literature

[1] Beutenmuller, William, Entomological News, Vol. XX, page 82. 1909.
[2] Felt, E. P., 29th Report of the State Entomologist of New York for 1913, page 19, 1915.
[3] Weiss, H. B., New Jersey Department of Agriculture, Circular 26, page 37, 1919.

THE MAPLE BORER

Glycobius (*Plagionotus*) *speciosus* Say

The sugar maple, a native tree planted extensively for shade and for ornament, is attacked by a number of insect enemies, the chief of which is the maple borer. Other species of maple do not seem to be attacked by this insect, but the sugar maple, whether it be planted as a street tree, a shade tree on the lawn, or growing wild in the pasture, woodland or along the roadside, is attacked and severely injured, particularly in the northeastern states. Certain trees once injured seem to be attacked each season year after

year until they finally succumb and are removed. Though this insect attacks and injures vigorous trees, those trees which are weakened from other injuries, or from growing in unfavorable situations seem to be more susceptible to attack.

Character of Injury

Trees attacked by the maple borer often show one or more dead branches, which will in time, break off unless removed. One of the commonest symptoms is to see certain branches on which the leaves turn red or yellow in late summer while the remaining foliage is still green. This indicates that the branch has been injured and is ripening its foliage prematurely. The most probable cause of injury is the maple borer, and the location of the burrows is indicated by ridges on the bark, and sometimes by sawdust thrown out of the openings. Old scars are usually quite prominent on the trunk and at the base of the larger branches, often seriously disfiguring and distorting the tree. The borer does

Figure 10. The maple borer, *Glycobius speciosus* Say, much reduced.

not usually tunnel in the twigs or branches in the upper portion of the tree; its attack seems to be confined to the trunk and base of the larger branches. The gallery is usually in the form of a spiral going upward and working around the trunk or branch. Sometimes it cuts squarely around as shown on Plate XII, b. The gallery is cut partly in the sapwood and partly in the bark, usually severing the cambium layer and partially girdling the tree. When nearly full grown the borer cuts a burrow half an inch in diameter. Consequently, when two or more borers are at work at the same time on a trunk or branch, it is often entirely girdled, and that portion above dies and breaks off. I have observed several cases where this has happened. Frequently a dead area is formed around each burrow, and it is a favorite point of attack for various borers of secondary importance, such as the maple sesian,

Synanthedon (*Sesia*) *acerni* and the pigeon horntail, *Tremex columba*. There are certain trees which show scars indicating that they have been subject to repeated attacks over a period of years. Also there are certain localities where nearly all of the sugar maple trees are attacked. For instance, on the hill along Prospect Street in New Haven, hardly a sugar maple has escaped, and many have been destroyed and removed. Plate XI shows some of these trees. Most of them now remaining are prominently scarred and deformed by the attacks of this insect. The writer visited Lanesboro, Mass., in August, 1922, and nearly all the village trees, which are sugar maples, were in unthrifty condition because of this insect. Though occasionally burrows are found as high as twenty-five or thirty feet from the ground, the attacks are usually not higher than fifteen feet.

Life History and Habits

The adult beetles mostly emerge during the first half of July in Connecticut, and may be found resting and crawling on the trunks of the host trees. Of course, some appear earlier and others later, but most of them emerge soon after July 1. In 1922, specimens were received from Ridgefield on June 22, from East Plymouth on June 27, and from Torrington on July 6. The Torrington correspondent stated that she had killed 35 of these beetles on her trees that season. Of 32 specimens now in the Station collection, 16 were taken between the first and fifteenth of July, five the latter part of June, six the last half of July, one August 15, and one September 14. June 22 is, therefore, the earliest date, and September 14 the latest. The beetles mate and the females lay eggs in July or early August, probably in the crevices of the bark of the trunk and at the base of the larger branches. These eggs soon hatch and the small grubs begin to tunnel in the bark and sapwood, making at first very small burrows. The point of entrance can usually be detected because of a discoloration on the bark caused in part by the exuding sap and in part by the excrement and sawdust thrown out of the minute burrow. Small particles often hang from the opening.

According to Dr. Felt, the grub passes the first winter in a shallow excavation in the sapwood, renewing its activity with increased vigor in the spring. Two years are supposed to be required for the development of this insect from the egg to the adult stage. The grub increases in size with age, and the tunnel becomes correspondingly larger as the grub advances, and of course, the sawdust becomes more conspicuous. On the approach of the second winter the grub works its way upward into the solid wood about four inches below the surface and then extending a few inches parallel with it. At the end of this deep

burrow, the grub passes the winter and also pupates, and from it the adult beetle works its way out through a hole nearly circular, but somewhat flattened, about three-eighths by five-eighths of an inch in size. The beetles prefer trees in the open and like to rest on the bark in the sunlight.

Description.

The adult is one of our most beautiful long-horned beetles, about an inch in length and three-eighths of an inch in breadth. It is black in color with bright yellow markings as shown on Plate XII, a. One conspicuous character is the W-shaped mark at the base of the wing-covers. The antennae are black, thorax black with lateral transverse yellow bands, and the wing-covers black with apex and several transverse and zigzag bands of yellow. Legs and under surface mostly yellow.

The larva is about two inches long when fully grown, cylindrical with a round head and without feet. The head and body are whitish, with mouth-parts brown.

Control Measures

All trees and branches killed by this borer as well as those nearly dead from its attacks should be removed, preferably before June, as some of the borers will then be destroyed before the adults emerge. Choice shade trees may be kept in a greater degree of freedom from borers if examined, carefully and thoroughly at least twice each year and the borers killed. These examinations should be made not too late in fall nor too early in spring. A good time is in September, before the grubs go into winter quarters, and again in May after they have resumed activity. Burrows may be located by the sawdust thrown out and sometimes by the sap, and by judicious cutting in the bark, it is possible to find the grub without seriously injuring the tree. Too much cutting might cause as much damage as the borer. Where there is a long burrow, it is not necessary to cut it open the whole length, but small cuts can be made through the ridge, here and there, until the borer is found. It is often possible to run a wire into the burrow and kill the grub without cutting until the grub is exposed. Some writers advise injecting carbon disulphide into the tunnel to kill the borer. This is effective if the tunnel is gas tight, and the opening should be closed with grafting wax, paraffin or a bit of moist soap. But on account of the uncertainty, most authorities do not trust the carbon disulphide method, but recommend cutting out or the use of the wire.

Wherever serious wounds are made in cutting, the cut surfaces should be covered with melted paraffin applied with a brush. All

dead areas where wood has been killed by the borers should be covered with paint. Most tree surgeons use coal tar paint, but good white lead and linseed oil, with just enough lamp black and burnt umber added to match the color of the outer bark makes a good tree paint. It is unsafe to use pine tar, or to add such ingredients as turpentine or dryer to the white lead paint.

It has been suggested that a deterrent wash be applied to the trunks and base of branches of trees so that the beetles will not oviposit there. Dr. Felt suggests carbolic soap, but possibly a lime-sulphur wash or a strong nicotine arsenate of lead mixture may answer the purpose. So far as I know the value of these applications has not been demonstrated.

Literature

Blackman, M. W., and Ellis, W. O. Bulletin N. Y. State College of Forestry. Vol. XVI, No. 26, page 60, 1916.

Britton, W. E. Connecticut Agricultural Experiment Station, Report for 1901, page 278; 1907, page 336.

Felt, E. P. Fourth Report, Fish, Game and Forestry Commission of New York, page 396, 1898.

———— Insects Affecting Park and Woodland Trees, Vol. I, page 51, 1905.

Jenkins, E. H., and Britton, W. E. Connecticut Agricultural Experiment Station, Bulletin 131, page 13, 1900; Report for 1000, page 337.

Kotinsky, Jacob. Farmers' Bulletin 1169, U. S. Department of Agriculture, page 53, 1921.

Lawrence, C. C. Tree Talk, Vol. III., page 112, 1916; Vol. V, page 20, 1923.

THE MAPLE SESIAN

Synanthedon (*Sesia*) *acerni* Clemens.

This is one of the minor pests of maple trees, and it seldom attacks a tree which is perfectly healthy. Wherever there is a wound, such as may be caused by a collision, borers, fire injury, or a stub left in pruning, this insect is apt to breed in the weakened tissues adjacent to the injury. It thus attacks both hard and soft maples. In front of the writer's residence in New Haven, are rows of silver maples planted as street trees between the curbs and the sidewalks. In 1919, a residence on an adjoining lot was moved into the next block, and pulley blocks were fastened to these trees near the base. This work was done the last few days of May and though the trunks of these trees were wrapped with burlap and blocks of wood placed under the ropes, in one case the bark was loosened around one side of the trunk near the base for half the circumference. Had it been noticed at the time proper treatment might have been given, but when first seen the bark was already dry and loose. This was removed, the wood

painted over and grafting wax applied on the exposed cambium around the wound. In 1921, the writer noticed that borers were at work in the bark just above the wound, and a few exit holes appeared that season. In 1922 there were many more of these holes (see Plate XIII, a) and on June 23, the writer found one of the adults just emerging from a burrow. The moth is shown on Plate XIII, b.

Dr. Felt[2] states that "trees wounded from any cause find great difficulty in the comparatively simple process of covering exposed wood with bark, after being attacked by this insect. Thus relatively insignificant wounds result in scars constantly increasing in size and finally in a badly disfigured, gnarled maple. These creatures, when abundant, may nearly girdle a tree." The distribution of this insect has been given by Mr. Beutenmuller as Canada, New England and Middle States, westward to Nebraska.

Life History and Habits

The eggs are laid on roughened areas on the bark in the vicinity of wounds in May or June. The newly hatched borers soon begin to tunnel in the bark and sapwood, reaching a length of about half an inch at the end of the season, when they suspend operations and pass the winter in the tunnels, which are nearly filled with frass. In the spring the caterpillar resumes feeding and completes its growth, eating its way to the surface, except for a thin layer, then retires into the tunnel and pupates in a loose silken cocoon. The pupa later works its way partly out of the tunnel; its skin splits open and the adult emerges, leaving the old pupa case protruding from the hole.

There is only one generation each season.

Description

The moths have been described by Beutenmuller as follows:

"Male: Head, collar, and palpi orange, orbits white. Antennae brown black. Thorax above and below yellow. Abdomen blue black more or less scaled with pale yellow, underside wholly yellow. Anal tuft bright orange. Legs pale yellow, tibiae with a black band at the end. Fore wings narrow, elongate, with narrow purplish borders more or less covered with pale yellow scales, outer part of wings pale yellow between the veins, with indications of a broken band. Discal mark large and deep black. Underside same as above. Hind wings transparent with the very narrow border and fringes purplish brown, sometimes yellow at the apex; underside similar to the upper, but with the costa marked with yellow.

"Female: Similar to the male. The margins of all the wings are darker in color and the hind wings want the yellow at the apex.

"Expanse: Male and female, 22-25 mm."

Natural Enemies

According to Felt[2] and Houser[4] woodpeckers constitute the most important natural check of this insect.

Control

Protect all trees as far as possible from mechanical injuries, as this insect works chiefly around wounds. The larvae work near the surface and on small trees may easily be dug out and destroyed. If the wounds are properly dressed and the cut surfaces coated with tree paint or carbolic acid emulsion about the middle of May, it will have a tendency to prevent egg laying by the females. Particularly should this emulsion be applied on the areas where these borers were at work the preceding year.

Literature

[1] Beutenmuller, William. Monograph of the Sesidae, Memoirs of the American Museum of Natural History, Vol. I., Part VI., page 294, 1901.
[2] Felt, E. P. Insects Affecting Park and Woodland Trees, Vol. I., page 56, 1905.
[3] Forbes, S. A. Twenty-sixth Report on the Noxious and Beneficial Insects of Illinois, page 35, 1911.
[4] Houser, J. S. Destructive Insects Affecting Ohio Shade and Forest Trees, Bulletin No. 332, Ohio Agricultural Experiment Station, page 322, 1918.

THE SPRUCE GALL APHID

Chermes abietis Linn.

One of the most serious pests of the spruce in Connecticut is the spruce gall aphid, and apparently this insect has increased in abundance during the past few years. The distinguishing characteristics of an infested tree are the green cone-shaped galls at the base of the new growth shown on Plate XX, a, and in extreme cases nearly every new shoot bears one of these galls at its base. Usually the shoot dies, and it is a common sight to see the dead twigs on spruce trees, each twig having a cone-shaped gall at the base. Continued attack seriously devitalizes the trees, and many large spruce trees have died in Connecticut during the last ten years. It would be perhaps an exaggeration to attribute their death solely to the attacks of this insect, but I believe it has contributed in a large degree. Wherever a tree becomes weakened, certain bark beetles begin to tunnel under the bark, and the tree is soon killed. Though several species of spruce are attacked by this insect, my observations indicate that the Norway spruce, *Picea excelsa,* is more susceptible to attack and more seriously

injured than any others Other spruces from which this insect has been taken are: the white spruce, *Picea alba*, black spruce, *Picea nigra*, blue spruce, *Picea pungens*, and the hemlock, *Tsuga canadensis*. Another species of gall aphid, *Chermes cooleyi* Gillette ocurs in Connecticut and makes larger galls on the blue spruce, *Picea pungens*, as shown on Plate XX, b.

This insect occurs throughout Europe, England and the northern part of the United States, from the Atlantic to the Pacific. Apparently it is more destructive in the New England States than elsewhere, though in the States of New York, Pennsylvania and New Jersey, it is reported as doing considerable damage.

From the notes of the nursery inspectors each year in Connecticut, I gather that this is one of the most prevalent of all nursery pests, and perhaps the most prevalent of all insects attacking conifers in Connecticut.

Life History and Habits

The life history was worked out many years ago by Professor R. A. Cooley and published by Professor Charles H. Fernald.[4] From this paper the chief facts are taken.

There are two annual generations of this insect which differ greatly in form, one being known as the winter generation and the other as the summer generation. The young females pass the winter on the twigs, especially around the buds, and in spring molt and complete their growth and secrete a woolly coating of wax filaments. They lay their eggs early in May, then die, though the woolly mass remains on the tree for a long time. The eggs hatch in about a week, and the young crawl to the tips where the new growth is just beginning to form, and there settle in the cracks at the base of the leaves, where the bud scales have already been deformed by the female, and are distinctly swollen at the base. The nymphs probably have some further influence on the formation of the gall, which as it develops, grows over the small insects and the cavities close except for a curved or semi-circular incision or opening surrounded by a pinkish or grayish pubescence. These nymphs live inside the gall until they reach maturity early in August, when the galls turn yellow, the cavities open, and the galls later become brown and die. The nymphs crawl out one at a time, molt and crawl over the leaves. They are now provided with wings and are the adult insects of the summer generation. In about two days each female attaches herself to a leaf, usually near the tip, and inserts her mouth parts. She does not move afterwards, but deposits a cluster of eggs, then dies, and her dead body protects the eggs which she has laid. Each egg is attached to the leaf by a slender stalk about as long as the egg itself, which is ellipsoidal in shape, about one-sixteenth of

an inch long and about half as thick. It is light yellow when first laid, but turns darker just before hatching.

These eggs hatch in about two weeks, and the nymphs scatter over the leaves and twigs, some crawling into the crevices at the axils of the leaves and buds. According to Cooley, only those nymphs which find protection at the base of the buds survive the winter, and most of them die.

Control Measures

On small trees the galls may easily be clipped off in June and burned. This treatment has already been practiced in one Connecticut nursery where many conifers are grown, and resulted in very few galls being found at the time of the annual inspection in August.

Spraying in April with a contact spray to kill the over-wintering females is one of the best control methods. Fernald[4] found that kerosene emulsion was not effective, but does not give the formula or rate of dilution. He states that whale oil soap, one pound in two gallons of water, proved so effective that no insects had since been found upon the trees.

For several years at the Elm City Nursery in New Haven, the spruce trees have been sprayed in April with miscible oil, one part in twenty parts of water The same treatment has also been applied late in the fall; and both have been effective in controlling the spruce gall aphid. There has never been any injury to the trees except once, and this probably was due to not mixing the contents of the original package thoroughly before diluting with water.

Literature

[1] Britton, W. E., Report Conn. Agr. Exp. Station for 1906, page 302.
[2] ———— *Ibid,* for 1916, page 139 (records *Chermes cooleyi* in Connecticut.)
[3] Felt, E. P., Insects Affecting Park and Woodland Trees, Vol. I, page 189, 1905.
[4] Fernald, C. H., and Cooley, R. A., Thirty-fourth Report Mass. Agr. College, page ...., 1898. (Gives life history studies made by R. A. Cooley).

THE BRONZE BIRCH BORER

Agrilus anxius Gory.

Many cut-leaf white birches in Connecticut have died during the past few years as a result of the attack of the bronze birch borer. Other trees without cut leaves have also been killed, but in most cases they represent the same species of tree, known as the European white birch, *Betula alba.* One such tree on the

Station grounds (see branch on Plate XIV, d) was killed by this beetle and removed in 1922. Native birches are not wholly immune from attacks, but seem to be much less susceptible than the European species. Mr. F. A. Bartlett of Stamford informs me that in one locality at least the native black birch, *Betula lenta,* has been seriously attacked and many trees killed by this insect. I have not observed injury to any of our native birches though the gray birch, *Betula populifolia,* is very common, and both the black birch and the paper or canoe birch, *Betula papyrifera* were growing in the vicinity of trees killed by this borer. According to Dr. Felt, this beetle attacks the black, yellow and cut-leaf white birches, and Dr. Lintner observed it on poplars, and Professor Davis has recorded it from willow.

Character of Injury

The first symptom generally noticed is that the foliage becomes thin in the upper portion of the top, and later the top-most branches die. Sometimes the following season the lower branches will have leaves all through the season, but often they will die in midsummer, and turn brown, but hang upon the tree. If examined carefully, ridges or swellings may be noted on branches half an inch to an inch in diameter, before anything wrong can be detected with the foliage. Sometimes there are oval swellings on the branches, but often there are distinct ridges, some spiral and some transverse, over the galleries. Later there will be many semicircular exit holes where the adults have emerged. There are also numerous rust-colored spots or patches on the bark where the burrows are near the surface.

If the bark is removed, we can see numerous irregular winding galleries, which often cross each other and which, in a badly infested branch entirely undermine the bark. The result of this attack is to girdle the branches, and death follows.

Life History and Habits

There is one annual generation and the larvae live through the winter in cells just under the bark, pupating early in May. The beetles emerge late in May or early in June and probably lay eggs either in June or July, in the crevices in the bark. The minute larva at first tunnels next to the bark, but as it increases in size goes deeper into the wood. The larvae reach maturity in October and form their hibernating cells. The beetles fly about and feed somewhat upon the foliage of willow, poplar and probably birch. Collected specimens in the Station collection bear the following dates and localities: Granby, 21 May, 1917; Farmington, 6 June, 1921. At the Station the beetles emerged from the dead wood on May 31, 1922, and during the next few days.

It has been observed that woodpeckers feed upon the grubs, and a small four-winged Chalcid fly, *Phasgonophora sulcata* Westw., has been reared from the galleries in New York State. Two specimens of this insect emerged from our material on July 3, and were determined by Mr. S. A. Rohwer.

Description

The adult beetle belongs to the family Buprestidae and is from one-third to one-half inch in length, about three-thirty-seconds of an inch in breadth and is olive brown or bronzy-green in color. It is shown on Plate XIV, c.

The larva or borer is one of the so-called flat-headed borers, and is about three-fourths of an inch in length, slender, with a flattened prothorax commonly called head. It is whitish with dark mouth parts.

Control Measures

All dead and infested trees and branches should be cut out and burned before May 15 in order to prevent the escape of the beetles. Only prompt community effort will check the devastations of this insect, and the destruction of individual trees here and there will not serve the purpose.

Literature

Blackman, M. W., and Ellis, W. O. Bulletin New York State College of Forestry, Vol XVI., No. 26, page 46, 1916.
Felt, E. P. Insects Affecting Park and Woodland Trees, Vol. I., page 284, 1905.
Houser, J. S. Bulletin 332, Ohio Agricultural Experiment Station, page 326, 1918.
Kotinsky, Jacob. Farmers' Bulletin 1169, U. S. Department of Agriculture, page 59, 1921.
Mutchler, A. J., and Weiss, H. B. Circular 48, New Jersey Department of Agriculture, page 4, 1922.
Slingerland, M. V. Bulletin 234, New York (Cornell) Agricultural Experiment Station, 1906.
Spicer, O. W. Tree Talk, Vol. 5, No. 1, page 21, 1923.

CONTROL OF ANT INVASIONS*

During the present season an unusual number of inquiries have come to the Station regarding ants and how to exterminate them. Each year ant colonies are reported from some localities as making ant hills on the lawn, injuring plants, entering houses, or perhaps tunneling in trees or timbers.

* Published as Bulletin of Immediate Information No. 17, July, 1922.

Ants belong to the Order Hymenoptera and are social insects living in colonies containing queens, males and workers. In general ants are considered as beneficial rather than injurious, as they work over the soil much like angleworms, and they devour particles of animal and vegetable matter, thus destroying many dead, and some living, insects. Certain species are distinctly injurious and are mentioned in the following pages.

The object of this bulletin is to give brief information about the habits of ants, and indicate how best to control them.

Nesting Places of Ants

Most of our common species of ants nest in the ground where they form ant hills, or reside under stones and pieces of wood. Certain species have large colonies and bring to the surface of the ground particles of sand and gravel, bits of wood and other materials, forming large ant hills. These ants cut off the roots of plants which happen to be where they make their galleries. Certain small species like the Argentine ant now present in our Southern States and the little red house ant or Pharaoh's ant,

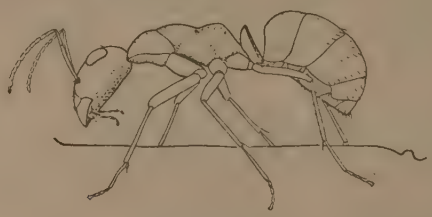


Figure 11. A common ant, *Formica fusca* var. *subsericea* Say, much enlarged.

occasionally found in Connecticut, may nest in houses. The large black ant or carpenter ant makes its nest inside the trunks of trees, old logs, stumps, fence posts, and in the structural timbers of buildings and bridges, often honeycombing and weakening the wood. The so-called white ants, or termites, have nesting habits similar to those of the large black ants, and often do considerable damage to structural timbers.

Ants on Peonies

Ants nearly always crawl about on peonies, though I have never known them to cause any injury. Peony buds are said to have nectar glands which attract ants, and this seems to be the most reasonable explanation of their presence on the plants, for as a rule peonies are not infested with aphids. Control measures are therefore not necessary, though in some cases it may be possible

to keep them away from the plants by mulching the latter with air-slaked lime, fine sifted coal ashes, or by wrapping the stems with sticky fly paper.

Ants and Pine Trees

In young white pine plantations, it has been noticed that the trees always die near the large ant hills,[1] and recent studies by Mr. H. B. Peirson[2] show that the ants kill the trees which are in danger of shading their nests. This is true not only of the pines planted, but also of native seedlings and sprouts of hardwood trees which spring up near the nests.

Ants on Trees and Plants

Except certain species of ants which nest in trees, those crawling about on the leaves and up and down the stems and branches are in search of food. An important article of ant food is the substance called honey dew exuded by certain insects, particularly aphids, psyllids, aleyrodids, tree hoppers and scale insects. Aphids are called the "milch cows" of the ants, and the latter are known to take care of certain species of aphids to the extent of carrying them in the fall to the roots and in spring back to the foliage. The ants are present, therefore, not to injure the plants, but to obtain foods from the aphids or scale insects which may be sucking sap from the plants. On account of the distinctly injurious nature of these insects, which are fostered by the ants, the latter are considered enemies of mankind.

In such cases, probably the best treatment is to spray the trees or plants thoroughly with a contact insecticide like kerosene emulsion, or nicotine solution and soap to kill the insects.

Ants in Gardens and Lawns

Ants often make small ant hills on lawns, especially in sandy soil, by bringing sand and fine gravel from their burrows to the surface of the ground. These are unsightly and interfere with the work of cutting the grass, especially with the edge on the knives of the lawn mower. They are also a nuisance by bringing particles of sand to the surface in cracks of walks and drives.

Where ants emerge through small cracks, carbon disulphide may be injected through the nose of an oil can and the hole stopped with soil. For nests in lawns, a hole should be made fifteen to eighteen inches deep with a crowbar, iron rod or stake, and the carbon disulphide poured into the hole. A half teacupful will

[1] *Formica exsectoides* Forel.

[2] Mound Building Ants in Forest Plantations, Journal of Forestry, Vol. 20, page 325, April, 1922.

be enough for the larger nests and the smaller ones may be given two large spoonfuls. As some of the ants will be out of the nest at the time of treatment, it may be necessary to repeat as soon as the ant colony resumes activity. The fumes of this ill-smelling liquid are volatile and will permeate the galleries and kill the ants in them. As carbon disulphide is inflammable, it should not be used near any form of fire, particularly in or around buildings or wooden structures. It comes in pound bottles and may be purchased from druggists.

Ants in Households

Most of the ant invasions in dwelling houses come from the colonies established in the garden or soil outside, and a destruction of these colonies will bring relief. The ants enter the house to obtain food and usually visit the kitchen and the pantry, where they gather crumbs of bread, cake, meat and particles of sugar to carry away to their young. These ants usually enter the house or cellar at a certain place and all of the individuals travel along this path or runway. A free use of naphthalene flakes scattered on the shelves, floors, corners and particularly along the runways and at the point of entrance will usually drive away most species within a few hours. Another common method to reduce their numbers is to saturate a coarse sponge with sweetened water and after permitting the ants to crawl into it, immerse the sponge in hot water and set the trap again.

Rarely there are cases where the ants nest in houses like the Argentine ant[1] which is now present in the Gulf States, and the little red house ant or Pharaoh's ant[2] which occurs in Connecticut, when the foregoing described methods of control are not effective, and it may be necessary to use a poisoned bait to exterminate the colonies.

The following formula was recommended by the U. S. Bureau of Entomology in Farmers' Bulletin No. 740, and has proved satisfactory against Pharaoh's ant in a dwelling house in Hartford:[3]

Poisoned Bait for Ants

Sugar	1 pound
Arsenate of Soda	125 grains
Water	1 quart
Honey	1 tablespoonful

Dissolve the sugar in the water, and add the arsenate of soda: boil until both are well dissolved, then add the honey which is

[1] *Iridomyrmex humilis* Mayr.
[2] *Monomorium pharaonis* Linn.
[3] Report of the Connecticut Agricultural Experiment Station for 1917, page 314.

said to attract the ants. When cool, use with bits of sponge in small shallow dishes, and place two or three dishes in each room. The object of this bait is not only to kill the ants which collect and carry the sirup back to the nests, but also the young and the queens in the nest which feed upon it. This poison should be kept away from young children and domestic animals.

Ants Tunneling in Wood

Black Ants

The large black ants commonly known as carpenter ants[1] nest in galleries which they eat in old logs, stumps, fence posts, rails, props and trees, and they occasionally eat away the timbers of houses to make their nests. They also gather sweets from kitchen and pantry. They both enter the house from outside, and in some cases nest in the structural timbers which soon may be considerably weakened.

Perhaps the best way to kill this species is to bore holes from the outside into the galleries and by means of a funnel, and rubber tube if necessary, pour in enough carbon disulphide to kill all ants inside the burrows. The hole should then be plugged to prevent the fumes from escaping. These large ants can also be trapped in sweetened sponges and can be fed with the poisoned bait if desired.

White Ants

There is in Connecticut another wood-eating species called the white ant or termite,[2] which is white in its immature stages but brown in the adult stage. These white ants are only remotely related to the true ants and belong to a different Order (Isoptera). They are social and nest in wood and swarm at a certain time in early summer. They do not visit the pantry and kitchen in search of food like the true ants, and so far as I know are not attracted by sweets. They often breed in stumps, fence posts, board edges of tar walks, old trees and sometimes in the timbers of houses and bridges. Other species in the tropics do a tremendous amount of damage by destroying buildings, and there are records of large structures collapsing because weakened by the feeding of these termites. There are many records in the United States and some in Connecticut of buildings having been injured by termites. In 1909, an old house in South Norwalk,[3] and in 1915 a house in Ridgefield,[4] had the timbers and finish boards

[1] *Camponotus herculeanus pennsylvanicus* DeGeer.
[2] *Reculitermes flavipes* Kollar.
[3] Report of the Connecticut Agricultural Experiment Station for 1909, page 373.
[4] *Ibid.*, 1915, page 187.

eaten by them. Trees and herbaceous plants in the field and greenhouse are occasionally attacked and injured. In 1914,[1] the author received geranium plants from New Rochelle, N. Y., where more than two hundred plants had been ruined by these insects which tunneled out the inside of the stems. In 1916, shot gun cartridges were received at the Station which had been eaten by white ants in a store in Wichita, Kans. In 1921,[2] a colony of these insects chewed off the insulation from the telephone wires in the basement of a large office building in New Haven.

There are also records of injury to food stuffs and other stored material, to fruit, nut, shade and forest trees, to field crops, garden vegetables, vineyards, nursery stock, shrubs, flowers and greehouse plants. Where white ants are tunneling in structural timbers, a free use of carbon disulphide as advised for the carpenter ant, is the best remedy. Probably creosote poured into the galleries afterward may have a tendency to prevent reinfestation. Some of the timbers near the ground may need replacing with cement concrete, which is proof against injury.

Winged Ants and Wingless Ants

In most of our species of true ants the workers are wingless, and the males and queens have wings.

The queen breaks off her wings (or the workers do it for her) soon after mating and after the swarming flight is over. It is the workers without wings which invade our houses, run over our trees and plants, make ant hills in the lawn, and tunnel in wood. Sometimes winged ants are seen at swarming time flying in the air or resting or crawling upon objects, but by far the most striking cases occur with our common white ant.[3] Often late in May brown winged males and females may be seen emerging in large numbers from a fence post, old stump or log, side of an old building or board along the edge of a tar walk. They fly through the air in swarms, mate, and migrate to new localities in this manner. A swarm will alight, the wings are broken off, and a new colony is started. We have all seen these wings upon the ground and supposed that birds or other animals had devoured the ants in a swarm, leaving only the wings, but such is not the case. The wings are broken off at a point near the body, and it is done by the ants themselves.

---

[1] *Ibid,* 1914, page 196.
[2] *Ibid.,* 1921, page 199.
[3] *Reculitermes flavipes* Kollar.

Summary of Control Measures

Kill ants in their nests by fumigating with carbon disulphide. Drive them out of houses by scattering naphthalene flakes on shelves and floors, particularly along the runways; trap them in sponges moistened with sweetened water. If these measures are not successful, use the poisoned bait described on page 364.

On trees and plants destroy the aphids or other insects which attract ants.

THE EUROPEAN CORN BORER

Pyrausta nubilalis Hubn.

This destructive pest has not yet been found in Connecticut, but may appear at any time. In fact the town of Douglass, Massachusetts, has just been found infested and placed under Federal quarantine, and this town joins Thompson, Connecticut. There has been a marked westward spread of this insect during 1922. The present infested area in North America is as follows:

Maine: All of York County, and the town of Sebago in Cumberland County: 28 towns.

New Hampshire: All of Rockingham, Strafford, Merrimack, Hillsborough and Belknap Counties; the towns of Holderness, Ashland, Plymouth, Bridgewater, Bristol, Hebron, Groton, Alexandria and Orange in *Grafton County;* Moultonborough, Tuftonboro, Wolfeboro, Ossipee, Effingham, Wakefield and Brookfield in *Carroll County*: total, 133 towns.

Massachusetts: All of Essex, Middlesex, Suffolk, Norfolk, Plymouth, Bristol and Barnstable Counties: the towns of Ashburnham, Gardner, Westminster, Fitchburg, Lunenburg, Leominster, Lancaster, Harvard, Hubbardston, Princeton, Sterling, Clinton, Berlin, Bolton, Rutland, Holden, West Boylston, Boylston, Northborough, Worcester, Shrewsbury, Westboro, Southborough, Millbury, Grafton, Upton, Sutton, Northbridge Milford, Hopedale, Douglas, Uxbridge, Mendon and Blackstone in *Worcester County*: total, 211 towns.

Rhode Island: All of Newport and Bristol Counties; and Cumberland, Lincoln, Woonsocket, Pawtucket, Providence, North Providence and East Providence in *Providence County*: total, 15 towns.

New York: In New York there are two separate infestations:

Eastern New York: All of Albany, Schenectady, Montgomery and Saratoga Counties; all of Fulton County except Stratford and Oppenheim, and all of Rensselaer County except Schodak,

Nassau, East Greenbush, Berlin and Stephentown; the towns of Hebron, Fort Edward, Greenwich, Easton, Jackson, Cambridge and White Creek in *Washington County;* Greenville, New Baltimore and Coxsackie in *Greene County;* Wright, Schoharie, Middleburg, Fulton, Cobleskill, Carlisle and Esperance in *Schoharie County;* Cherry Valley in *Otsego County;* Wells, Lake Pleasant, Benson and Hope in *Hamilton County;* total, 88 towns.

Western New York: All of Niagara and Erie Counties; all of Wyoming County except Covington, Castile, Seneca Falls and Pike; all of Chautauqua County except Busti, Kiantone, Carroll and Poland; the towns of Alabama, Pembroke, Batavia, Stafford and Darien in *Genessee County;* Perrysburg, Dayton, Persia, Otto, East Otto, Ashford, Yorkshire, Freedom, Machias, Leon, New Albion, Mansfield, Ellicottville, Franklinville, Napoli, Little Valley and Salamanca in *Cattaraugus County;* total of 93 towns. Total for New York, 181 towns.

Pennsylvania: All of Erie County, except Union and Concord; the town of Beaver in *Crawford County*: total, 21 towns.

Ohio: All of Lake County; the towns of Conneaut, Monroe, Pierpont, Kingsville, Sheffield, Denmark, Ashtabula, Plymouth, Jefferson, Saybrook, Austinburg, Geneva and Harpersville in *Ashtabula County;* Chester, Chardon and Thompson in *Geauga County;* Dover, Rockport, West Park, Middleburg, Cleveland, Euclid, Independence, Newburg, Warrensville and Mayfield in *Cuyahoga County;* Brownhelm, Black River, Amherst, Sheffield, Elyria, Avon and Avon Lake in *Lorain County;* Margaretta, Portland, Perkins, Huron, Berlin and Vermillion in *Erie County;* Allen, Clay, Benton, Carroll, Danbury, Erie, Bay, Portage, Middle Bass Island, North Bass Island, South Bass Island and Catawba Island in *Ottawa County;* Townsend in *Sandusky County;* Ross and Lake in *Wood County;* Washington, Toledo, Oregon and Jerusalem in *Lucas County;* total, 67 towns.

Michigan: The towns of Exeter, Berlin, Frenchtown, Monroe, Ida, LaSalle, Whiteford, Bedford and Erie in *Monroe County;* Greenfield, Hamtramck, Gratiot, Grosse Pointe, Springwells, Detroit, Ecorse, Monguagon, Brownstown and Huron in *Wayne County;* total, 19 towns

Ontario, Canada: The following Counties are entirely infested: Essex, Elgin, Middlesex, Oxford, Perth, Norfolk, Brant, Waterloo, Haldimand and Welland; all of *Kent County* except Raleigh, Romney and East Tilbury; all of *Lambton County* except Moore; all of *Huron County* except Ashfield, East and West Wawanosh and Howick; all of *Lincoln County* except Grimsby and Cristor, Culross in *Bruce County;* Guelph in *Wellington County;* East and West Flamboro and Ancaster in *Wentworth County;*

Trefalgar in *Halton County;* Chinquacousy in *Peel County;* Scarboro and York in *York County;* Pickering, East and West Whitby in *Ontario County;* Clarne in *Durham County* and Brighton in *Northumberland County;* total, 139 towns.

MISCELLANEOUS INSECT NOTES

Chinch Bugs Injuring Lawn: On September 22, 1922, a sample of soil and grass was received from Hartford, where the grass had been killed in spots. Examination showed the presence of many chinch bugs, *Blissus leucopterus* Say, which were probably responsible for the killing of the grass. A similar infestation occurred on a lawn in Bristol in September 1914. An application of kerosene emulsion, nicotine solution, or even strong soap suds would probably kill these bugs without injuring the grass.

The Sour Gum Leaf-Miner: This insect attacks the sour gum, pepperidge, or tupelo, *Nyssa sylvatica,* and is called the sour gum leaf-miner or case-bearer. The adult is a small moth *Antispila nyssaefoliella* Clem., and its larva is a miner in the leaves. Certain trees in Orange were brown in September because of this attack and hardly a leaf escaped. In 1893 this insect was very abundant, and injured the sour gum trees on Long Island. No remedy is known.

The Blue Elm Beetle: On September 11, Mr. G. A. Cromie, Superintendent of Trees, New Haven, brought to the Station some small dark blue beetles which were found feeding upon elm trees in West Haven. This is *Altica ulmi* Woods, a species described in 1918 and formerly confused with the strawberry flea beetle, *A. ignita Ill.* We have received this insect on elm from Salisbury in 1902, from Stonington in 1907 and from Old Saybrook in 1908. It does not seem to do much damage, but in case it becomes abundant, the proper treatment is to spray with arsenate of lead.

Scolytid Beetles in Pine Twigs: On October 7 and 17, 1921, Mr. H. W. Hicock, Assistant Forester of this Station, brought to the office some white pine twigs from Canaan, in which small beetles were tunneling lengthwise. This caused the tips of the branches to turn brown, and in some cases there were as many as one hundred brown tips on a tree. The beetles responsible for this injury were sent to Dr. J. M. Swaine of the Entomological Branch, Ottawa, Canada, who identified them as *Pityophthorus ramiperda* Swaine, a species described from Canada which "kills twigs by excavating tunnels in the pith as well as in the bark."

Leaf-Miner in Cultivated Sorrel: While attending a field meeting of the Connecticut Vegetable Growers Association at

Windsor, Conn., June 24, 1922, the writer collected a number of leaves of cultivated sorrel, containing larvae of a leaf-miner. At this time the crop had been nearly all harvested, but there were still many plants left in the fields. These plants were badly infested, often two or three leaves on a plant showing the characteristic work of this leaf-miner. Some of this material was collected and placed in breeding cages. On July 15, adults began to emerge, and proved to be *Pegomyia calyptrata* Zett., a fly, closely related to the spinach leaf-miner. The identification was made by Mr. Charles W. Johnson. M. P. ZAPPE.

Beetles Boring in the Timbers of an Old House: On June 23, some specimens of beetles were received from Durham, which were boring in the sills and floor timbers of an old house. The beetles proved to be *Hadrobregmus carinatus* Say, of the family Anobiidae, formerly placed in the Ptinidae and closely related to the Bostrichidae. They are brown in color and about three-sixteenths of an inch long, much larger than the powder post beetles of the genus *Lyctus*. They also make larger holes in the timbers. As no member of the staff visited the place, we do not know whether the beetles burrowed entirely through the timbers or whether they worked only in the sapwood, as is the case generally with the powder post beetles.

A Rare and Curious Horn Worm: On July 14, two horn worms or sphinx larvae on grape leaves were handed to Mr. Walden. They were about two inches in length, brown, with caudal horn and a black spot just back of the head. At first we were unable to identify these larvae, which were unfamiliar to all members of the staff. After much searching, from published descriptions we were finally able to identify the species as *Dilophonota ello* Linn. The larva is shown on Plate XIV, a. During a period of more than twenty years' work in collecting and rearing insects, we never saw this larva before, and our collection contains no adults. These larvae were placed in a cage in the insectary, but they refused to eat any kind of food given them and finally died, apparently of a bacterial wilt. They are said to feed upon *Euphorbia*, but though plants representing several species of this genus were placed in the cage, they refused to eat.

Galls on European Willows: While inspecting a shipment of Manetti rose stocks at Cromwell, imported from Oudenbosch, Holland, the writer noticed some oblong swellings on the willow shoots which were used in tying together the bundles of Manetti stock. On cutting into these galls, they were found to contain small white larvae. Specimens of the galls were collected and sent to Dr. E. P. Felt, State Entomologist, Albany, New York. They were identified by his assistant, Mr. D. B. Young, who stated that: "they are undoubtedly the galls of *Rhabdophaga salicis*

Schrank." This insect has evidently become well established in this country, and there are records of its causing injury to willows in New York State as far back as 1898.* All the tying willows were cut from the bundles of Manetti stock and burned in the furnaces of the greenhouse heating plant, thus eliminating any chance of re-establishing this insect in Connecticut.

M. P. ZAPPE.

The Cottony Cushion Scale in a Connecticut Greenhouse: On January 6, 1921, a curious fluted scale insect on *Acacia* was received from Mr. Nathaniel Slocombe of Farmington. Further study by the staff of this Department leads us to conclude that this is the well-known cottony cushion scale, *Icerya purchasi* Maskell, an Australian species which, in some way, became introduced into California, and for a time in the eighties seriously threatened the citrus fruit industry of California. It was not until an entomologist was sent to Australia and collected and brought back specimens of a little lady beetle, *Novius cardinalis* Muls., that the insect began to disappear. This lady beetle feeds upon the young scales, and it soon became so abundant as to overcome the pest, which has never assumed prominent proportions in California since. Of course, this scale might be shipped anywhere on tropical plants, which in Connecticut are grown under glass, as in former years this class of stock was brought into the country without inspection.

Maggots Appearing in Factory: On April 24, a number of fat, dirty, white maggots or Dipterous larvae were brought to the Station from a factory of the C. & K. Mfg. Co., in New Haven. This firm manufacturers powder puffs and novelties on Daggett Street, but on the next floor of the same building a firm uses cheese in the manufacture of crackers or biscuits. These maggots, in considerable numbers, dropped from the ceiling in the rooms of the C. & K. Mfg. Co., and one of the proprietors brought them to the Station for identification and to learn something about their life history and habits. They were placed in breeding cages, and on May 16, several adults emerged, which were identified by Mr. Charles W. Johnson as *Cynomyia cadaverina* Desvoidy. It was learned that the firm on the floor above, being troubled with rats, had used rat poison, and possibly some rats had died between the floor and ceiling or in the partitions. These maggots, therefore, may have bred in dead rats or in some accumulation of cheese or other waste food materials, and on reaching larval maturity, as is their habit, worked downward in search of a proper place to transform. They usually pupate in the ground.

* Twenty-ninth Report of New York State Entomologist, page 96, 1915.

A Borer in Rose Stems: On August 5, specimens were received from the Rowayton Greenhouses, Traendly & Schenck, proprietors, of rose stems with larvae tunneling lengthwise in the flower stems. Several of these larvae were alive and were placed in breeding cages, but the adults have not yet emerged. Dr. Garman was able to identify the larvae from Mr. Middleton's published descriptions and figures[1], as *Adirus trimaculatus* (Say), a native species of the family Cephidae, closely related to the sawflies. Dr. Garman and Mr. Walden visited the greenhouses on August 9. Hardly any infested stems could be found, as most of them had been cut out and destroyed. The larvae are cylindrical, pinkish-white and a little less than an inch in length. Usually they are borers in blackberry stems, but occasionally attack rose. In the Rowayton case, the greenhouse had been rebuilt and for several weeks during the summer there was no glass on the roof. The Station collection contains two adult specimens of *Adirus trimaculatus,* one collected in Hamden, 15 June 1918, by M. P. Zappe, and the other in Orange, 2 June 1920, by W. E. Britton. The adult is a black four-winged fly with body slender and nearly half an inch in length, and with smoky wings.

Rose Midge in Connecticut: On November 1, some rose tips were received from Mr. John McCarroll, gardener on the Truesdale place, Indian Field Road, Greenwich. The tips had crushed larvae in them which Dr. Garman recognized as the rose midge, *Dasyneura rhodophaga* Coq. Dr. Garman and Mr. Zappe visited the place during the afternoon of that same day, and found that in a small greenhouse the buds and young leaves of the rose plants had been attacked by this insect. But as the gardener had picked off and destroyed many infested buds and leaves, the insect was not very abundant. This insect has caused considerable damage in some of the large greenhouses around Baltimore, Chicago, Ohio and in Canada, but this is the first definite record that we have of this insect occurring in Connecticut, though no doubt it has been present in rose houses for some time, and not called to our attention. According to Mr. Sasscer[2], one of the most effective means of control is that worked out by Professor E. N. Cory of the Maryland Station, and consists in covering the surface of the soil in the rose beds with a layer from one-fourth to one-half inch deep with tobacco dust, and to fumigate the house nightly by burning tobacco stems, or one of the nicotine preparations.

Cutworms Injuring Strawberries: On April 19, a strawberry grower near New Haven brought to the laboratory some cutworms and strawberry plants injured by them. The leaves were

[1] Proceedings Entomological Society of Washington, Vol. XIX, page 174, 1917.

[2] Bulletin No. 778, U. S. Department of Agriculture, 1919.

badly eaten, and many of the stems had been cut off close to the crown. The larvae were apparently full-grown, and the indications were that most of the damage had been done. It was suggested to the grower, however, that he try a poisoned bran mash against the larvae. The specimens were placed in the insectary and the larvae soon pupated. Adults emerged on May 21 and proved to be *Noctua c-nigrum Linn.* This is called the spotted cutworm, a well-known injurious species, attacking many different crops. The larva is about one and one-half inches long when full-grown, of a grayish-brown color with two rows of triangular dark spots, which increase in size towards the rear end. An injured strawberry plant with a larva is shown on Plate XVI.

B. H. WALDEN.

Larvae Feeding Upon Pansies: In the spring of 1922, pansies growing in a cold frame in the writer's garden were injured by having both leaves and flowers eaten. Some flowers had the petals nearly all devoured, and others were only notched: the leaves were also eaten, both forms of injury being shown on Plate XVII. At first it was supposed to be the work of slugs, but on searching, some small Lepidopterous larvae resembling small cutworms were found in the soil around the plants. These were gathered by hand each day for several days, but the injury did not cease, and finally the plants were thoroughly sprayed with arsenate of lead. After this there was little or no further injury. Larvae were collected on May 8 and placed in cages in the insectary. In due time they became full-grown and pupated in the soil. On September 23, the adult emerged and proved to be a Noctuid moth, *Feltia venerabilis* Walker. This species is usually classed as one of the cutworms, though these larvae did not cut off the stems of the plants, but devoured the leaves and blossoms. Gibson[1] reports *F. venerabilis* as destroying plants in vegetable gardens in Canada, and in 1914 it was found injuring oats.

A New House Fly in Connecticut: During the late summer and fall of 1922, large flies were noticed as being rather common in the laboratory buildings at the Station, as well as in the residences of members of the staff. Little attention was paid to them except to kill them, as they were supposed to be some common and well-known species. On November 14, 1922, a letter was received from Mr. Charles W. Johnson, Curator of the Museum of the Boston Society of Natural History, stating that a large, blue-black fly, three or four times the size of the common house fly, a European species, had made its appearance in the vicinity of

[1] Bulletin No. 10, Entomological Branch, Canadian Department of Agriculture, page 31, 1915.

Boston. It was first taken in Connecticut by Dr. W. M. Wheeler and Mr. K. F. Chamberlain. From the abundance of this fly south and west of Boston, Mr. Johnson inferred that this fly was introduced further south, and asked whether we had observed it in New Haven. Specimens were collected and sent him, and a reply received November 24 stated that this fly is the European *Muscina pascuorum* Meigen. He regarded it as remarkable that an introduced species should gain such great headway before being discovered. Mr. Johnson read a paper on the subject before the entomological meetings in Boston, December 26, 1922.

The Hemlock Web Worm: On April 26, when the writer and Mr. Zappe visited South Manchester to examine rhododendron plantings infested by the rhododendron borer, small larvae and slight webs were noticed on some hemlock trees on the grounds. Some of the leaves were eaten off and fastened together by silk threads, thus making a loose case (see Plate XVIII) in which the larva lives and feeds on the leaves from the inside of the case. These severed leaves turned brown, and as the cases were abundant, the dead patches were rather conspicuous on the trees. Some of the larvae were bright green, and others were brown, but all seemed structurally alike and about one-fourth of an inch in length. These tiny larvae would drop downward on their silk threads when disturbed. The work of this insect was also noticed by the writer in Keney Park, Hartford, on April 29. Material was placed in the insectary and adult moths emerged on May 25 and 31. The insect is a small moth, *Gelechia abietisella* Pack., of the family Tineidae, and must lay its eggs on the leaves during June. It is thought to be single brooded and that the caterpillars become nearly full-grown by winter, and pass the winter in their cases and become again active in the spring.

On May 23, 26 and 31, several Hymenopterous parasites emerged. These were sent to the U. S. National Museum and identified as belonging to the genera *Copidosoma* (3 specimens), *Apanteles* (2 specimens), *Eubadizon* (1 specimen) and *Bassus* (1 specimen).

The moth has a wing expanse of three-eighths of an inch, whitish with ends of wings and fringe light brown, and with darker transverse bands on the costal margin of the fore wings.

Rose Chafers in Vineyard: On June 10, I visited the 80-acre vineyard of Mr. P. M. D'Esopo in Marlborough. The owner reported severe injury in 1921 from the rose chafer, *Macrodactylus subspinosus* Fabr., and feared that the partial loss of his crop might follow the attacks of these beetles in 1922. At the time of my visit, the adults had just begun to appear on the vines, but were not very abundant. The owner expected that they would be present in full force a few days later, and was spraying the

vines with arsenate of lead to prevent injury. While present, I mixed up a barrel of self-boiled lime-sulphur, and the men applied it to certain rows on one side of the vineyard. I also applied two gallons of "Derrisine" with a hand pump to a few vines near the buildings. Mr. Walden and I visited the vineyard on June 15. There were only a few rose chafers on the vines sprayed with self-boiled lime-sulphur, and though not extremely abundant anywhere, they were present in greater numbers on vines sprayed with lead arsenate. It seemed to us that the rose chafers were nowhere sufficiently abundant to cause material damage to the crop, and they had not greatly increased in numbers since my former visit on July 10. The "Derrisine" had a strong and characteristic odor when first applied, but this had all disappeared by June 15, and there were then a few chafers on the vines. Apparently the self-boiled lime-sulphur acts as a repellent against the rose chafer and has proved quite successful in New Jersey.

Cutworms Attacking Raspberries and Asparagus: While examining raspberry plants in a field in East Haven on May 8, it was noticed that the lower leaves, especially those of the new canes, had numerous holes apparently eaten by some insect. The foliage was examined hastily and no insects were found that would cause the injury. The plants were examined again on May 16, when it was found that the injury had increased. The soil around the base of some of the plants was dug away, and a number of cutworms about an inch long were found a short distance below the surface. A number of the larvae were collected to rear, and adults emerged from this material on June 28, belonging to two species, *Paragrotis messoria* Harr., and *Paragrotis tessellatus* Harr. The larvae of both of these species are climbing cutworms, and are well-known pests, having a large variety of food plants. Similar injury was observed on red and black cap raspberries in North Branford and Montowese, At Montowese, in an asparagus field near the raspberries, many of the new stalks were crooked and badly distorted, making them unfit for market. It was found that nearly all of the crooked stalks had been eaten on the inner side. A cutworm was found in the soil at the base of the stalks showing fresh injury. While no adults were reared from these larvae, it is quite probable that it was one of the species attacking raspberries. A number of asparagus stalks showed injury from frost or cold weather, but the tips of these were somewhat shriveled and had a whitened or blasted appearance readily distinguished from those injured by the cutworms. The injuries caused by these cutworms and the adult of *Paragrotis messoria* Harr, are shown on Plate XIX.

B. H. Walden.

Cabbage Worms Controlled by Sulphur-Lead Arsenate Dust: The imported cabbage worm, *Pontia rapae* Linn., was sufficiently abundant to have caused serious injury to an experimental block of cabbage at the Station Farm the past season. An application of dust prepared by mixing ten pounds of dry lead arsenate with ninety pounds of dusting sulphur was applied August 21 with hand dusters. The heads were about one-third to one-half grown.

An examination of the plants a few days later showed that the treatment was very effective in killing the imported cabbage worm. The cabbage looper, *Autographa brassicae* Riley, was also present in small numbers, and those that had gone far into the heads were not affected by the treatment. When the looper is present, in order to be effective the treatment should be applied before the worms have entered the head.

It is difficult to coat the smooth foliage of the cabbage thoroughly with a spray. It is necessary to use a spreader, such as casein and lime, with a lead arsenate spray. While no comparison was made between the dust and a spray, the indications were that dust gave as good results as could be expected.

Probably hydrated lime could be used as a carrier for the lead arsenate in place of the sulphur, so that the dust mixture would cost no more than the spray with a spreader. The dust can be applied more cheaply than a spray. B. H. WALDEN.

Springtails Injuring Vegetable Seedlings: On May 29, the New Haven County Farm Bureau advised this Department that the gardener on an estate in Pine Orchard was having trouble with a small "black bug" which was destroying his vegetable seedlings, and requested that the matter be investigated. The place was visited on the same day, and it was found that springtails were causing the injury. Specimens were collected and sent to Professor J. W. Folsom, Urbana, Illinois, who identified the species as *Sminthurus hortensis* Fitch.

The garden had been on the same ground for a number of years, and liberal amounts of stable manure had been used. The gardener stated that the insects were very abundant at the time the first seedlings came up and had since been gradually disappearing. The first plantings of carrots, beets, swiss chard, spinach and onions were practically destroyed soon after the leaves appeared. These vegetables had been replanted, and from one-third to two-thirds of these plants had been destroyed. The second planting of onions was not as severely injured as the other vegetables. This was the first year that the gardener had been on the place, but he was informed that this trouble had been experienced for several seasons.

While but few of the springtails were observed on May 29, six rows of spinach were thoroughly dusted with sulphur-nicotine dust. The spinach was examined on June 1. No springtails were found on the dusted plants, and only an occasional one was found on the ground under these plants, but it was found that the insects had also nearly all disappeared from the untreated rows. It will be necessary to make tests earlier in the season when the springtails are more abundant in order to get any conclusive data regarding control measures.

B. H. WALDEN.

Clothes Moths: On December 9, 1921, specimens of small, white Lepidopterous larvae were brought to this office by an agent of a casket manufacturing concern in New Haven. The casket manufacturers had sold some caskets to an undertaker in 1919. Two of these caskets were covered on the outside with a gray woolen material and were lined with silk on the inside. About one year after they were purchased, holes were eaten through the gray cloth covering and the undertaker requested the manufacturers to recover one of these caskets which was done. When the manufacturer again received a request to recover another casket, he felt reluctant to go to this expense, unless it could be shown that the caskets were infested with "bugs" when the undertaker bought them. To settle this controversy, this office was called on for information as to what the insects were and where they were coming from. As it was difficult to determine these points from an examination of the larvae, the writer visited the undertaker's establishment to see the casket and the surroundings.

The casket was quite badly infested with small, white larvae, from some of which adults were reared. It proved to be one of the clothes moths, *Tinea pellionella* Linn. A few of the larvae were feeding on the woolen cloth on the outside of the casket, but most of them were on the inside, where the outside covering lapped over the edge. This lapped material was covered with silk on the inside, making a dark place for the larvae to work. The wood of which the casket was built had been tunneled by wood-boring insects and wherever these tunnels opened on the outside of the casket, the clothes moth larvae had eaten the cloth away, leaving a round hole. Apparently the larvae had crawled into these holes in the wood to pupate and before emerging as adults, had eaten through the cloth for exit. This led the undertaker to believe that the insects were coming from the wood and had been in the caskets since he purchased them.

The undertaker's rooms adjoined those of a tailoring establishment and also a hat shop. In these shops it is the habit to keep the scraps of felt and wool cloth in the back rooms, and

this material was undoubtedly infested with clothes moths. The undertaker said that in the fall he had noticed large numbers of small moths flying about. Probably it was these moths which started the infestation in the caskets.

A short time later another large infestation of clothes moths was seen in a warehouse which supplied retail stores with athletic and sporting goods, hardware, etc. Here the infestation had apparently started, or at least the greatest number of larvae were found in felt weather strips. Many moths had emerged from these strips and many larvae were still present in them. The weather strips were a complete loss and were all burned immediately. Other material subject to infestation, such as sweaters, jerseys, camel's hair brushes, trout-flies, etc., was in danger of being attacked and was exposed so that the adult moths could get at it. It was suggested to the man in charge of the warehouse that when all the moths had disappeared, this material could be placed in the ovens of the wood kiln drying plant and subjected to very high temperature to kill any eggs or larvae that might be left in it.

M. P. ZAPPE.

NOTE REGARDING AUTHORSHIP.

For bibliographical purposes, all notes and articles in this Report (Bulletin 247) should be credited to W. E. Britton, except where otherwise indicated.

ILLUSTRATIONS.

The illustrations in this Report (Bulletin 247) are from the following sources: Text figures are all from drawings as follows: Figs. 4 and 5, Map drawn by A. E. Moss, shaded by Stoddard Engraving Co.; Figs. 6, 7, 8, 9 and 11 from original drawings by Dr. Philip Garman; Fig. 10, from Spray Calendar, drawn by Mrs. E. L. Beutenmuller; Plates V, VI, VII, VIII and XII, b, from photographs by W. E. Britton; Plates IX and X, from photographs by Dr. Philip Garman; Plate XII, a, from photograph by H. A. Doty; Plate XIII, b, photographed from a colored plate published by Dr. E. P. Felt; all others from photographs by B. H. Walden.

INDEX

Adirus trimaculatus, 372
Adoretus tenuimaculatus, 346
Agrilus anxius, 278, 359
Agrilus sp., 284.
Alder spittle bug, 272
Alsophila pometaria, 275
Altica ignita, 369
  ulmi, 277, 369
Anomala orientalis, 277, 345
Anastatus bifasciatus, 314
Ants, 278
  Control of, 361
Ant, Argentine, 364
  Carpenter, 365
  Common white, 365, 366
  Pharoah's, 364
  White or Termite, 365
Antispila nyssaefoliella, 278, 369
Anuraphis roseus, 275
Apanteles fulvipes, 315
  lacteicolor, 316
  melanoscelus, 315
  sp., 374
Aphid, Green apple, 275, 279
  Pea, 276
  Potato, 276
  Rosy apple, 275
  Spruce gall, 279, 357
  Turnip, 276, 346
  Woolly apple, 279
Aphis pomi, 275
  pseudobrassicae, 276, 346
Apple and thorn skeletonizer, 273, 274, 279
Apple maggot, 275
  red bug, light or false, 275
  rust, 279
  scab, 279
  twig miner, 275
Argyresthia thuiella, 278
Aspidiotus perniciosus, 276
Autographa brassicae, 376
Bassus sp., 374
Beetle, American raspberry, 272
  Blue elm, 277, 369
  Colorado potato, 276
  Elm leaf, 277
  Imported poplar and willow, 277
  Japanese, 345
    of Hawaii, 346
Beetle, margined blister, 276
  Poplar leaf, 279
  Scolytid, 369
  Strawberry flea, 369
  Striped cucumber, 276
Birch leaf skeletonizer, 277
Blepharipa scutellata, 316
Blissus leucopterus, 369
Blister mite, 279
  rust, 279
Borer, Bronze birch, 278, 359
  European corn, 367
  Maple, 277, 351, 352
  Peach, 331
  Raspberry cane, 276
  Rhododendron, 276, 278, 347, 349, 350
  in rose stems, 372
  Stalk, 276
Brown-tail moth, 274, 284, 290
  parasites, 316
Bucculatrix canadensisella, 277
Bud moth, 275
Buffalo tree hopper, 275
Byturus unicolor, 272
Cabbage root maggot, 332
Cabbage worms, 376
Calosoma sycophanta, 314
Camponotus herculeanus pennsylvanicus, 365
Ceresa bubalus, 275
Chermes abietis, 279, 357
  cooleyi, 279, 358, 359
Chinch bugs, 369
Chianaspis sp., 344
Chloridea obsoleta, 276, 343
Clastoptera obtusa, 272
Clothes moths, 278, 377
Cockroach, 278
Compsilura concinnata, 316
Conotrachelus nenuphar, 275
Copidosoma sp., 374
Corn ear worm, 276, 343
Crown gall, 279, 284
Culex pipiens, 326, 327
Cutworms, 276
  on raspberries and asparagus, 375
  on strawberries, 372
  Spotted, 373
Cynomyia cadaverina, 371

Dasyneura rhodophaga, 372
Diabrotica vittata, 276
Dichomeris marginellus, 278
Dilophonota ello, 370
Diprion sp., 284
Emphytus cinctus, 284
Epicauta marginata, 276
Eubadizon sp., 374
Euproctis chrysorrhoea, 284
European red mite, 273, 275, 333, 338
Fall canker worm, 275
  webworm, 277
Feltia venerabilis, 373
Financial statements, 270, 321, 322, 329
Fire blight, 279
Fly, New house, 373
Foul brood, American, 286
  European, 285
Formica exsectoides, 363
  fusca var. *subsericea*, 362
Galerucella luteola, 277
Gelechia abietisella, 374
Gipsy moth, 274, 290
  parasites, 313
  quarantine, 317
  Statistics of infestations, 310
  Summary of infestations, 313
Glycobius speciosus, 277, 351, 352
Hadrobregmus carinatus, 370
Hemerophila pariana, 273, 274
Hemlock web worm, 374
Horn worm, 370
Hyphantria cunea, 277
Icerya purchasi, 371
Inspection, Apiaries, 284
  Imported nursery stock, 282
  Nurseries, 279
Iridomyrmex humilis, 364
Iris weevil, 278
Juniper web worm, 278
Lady beetle, 371
Laspeyresia molesta, 275
Leaf miner, Arbor vitae, 278
  in sorrel, 369
  Tupelo or sour gum, 278, 369
Lecanium, 279
Leptinotarsa decemlineata, 276
Lygidea mendax, 275
Macrocentrus sp., 349
Macrodactylus subspinosus, 276, 374
Macrosiphum pisi, 276
  solanifolii, 276
Maggots in factory, 371
Malacosoma americana, 275
Maple sesian, 352, 355
Marmara elotella, 275
Meteorus versicolor, 317
Monodontomerus aereus, 315
Monomorium pharaonis, 364
Monychus vulpeculus, 278
Mosquito control work, 326
Muscina pascuorum, 374
Noctua c-nigrum, 373
Novius cardinalis, 371
Oberea bimaculata, 276
Oligonychus americanus, 340
Papaipema nitela, 276
Paradichlorobenzene, 331
Paragrotis messoria, 375
  tessellatus, 375
Paratetranychus bicolor, 338, 340
  pilosus, 273, 275, 333, 338
  ununguis, 273, 338, 340, 341
Peach moth, Oriental, 275, 279
Pear psylla, 276
Pegomyia calyptrata, 370
Phasgonophora sulcata, 361
Phenacoccus acericola, 277
Phorbia brassicae, 332
Pigeon horntail, 353
Pityophthorus ramiperda, 369
Plagiodera versicolora, 277
Plagionotus speciosus, 351
Plum curculio, 275
Pontia rapae, 376
Popillia japonica, 345
Poplar canker, 279
Porthetria dispar, 274
Psylla pyricola, 276
Pteromalus egregius, 317
Pyrausta nubilalis, 367
Raspberry leaf curl, 279
Reculitermes flavipes, 365, 366
Rhabdophaga salicis, 284, 370
Rhagoletis pomonella, 275
Rhododendron lace bug, 279
Rose chafer, 276, 374
Rose midge, 372
Scale, cottony cushion, 371
  Elm, 279
  Euonymus, 279, 344
  Oyster shell, 279
  Pine leaf, 279
  Rose, 279
  San José, 276, 279, 329
  Scurfy, 279
  Tulip tree, 279
  West Indian peach, 279
  Woolly maple leaf, 277
Schedius kuvanae, 314, 315
Schizotetranychus schizopus, 339, 340

Scolia manilae, 346
Sesia acerni, 353, 355
rhododendroni, 278, 347, 349, 350
Sminthurus hortensis, 376
Springtails, 376
Spruce mite, 338, 340, 341
Sturmia nidicola, 316
Synanthedon acerni, 353, 355
exitiosa, 331
Tent caterpillar, 275
Tenuipalpus lineola, 339
Tetranychus bioculatus, 339
populi, 339
salicicola, 339
Tinea pellionella, 377
Tmetocera ocellana, 275
Tremex columba, 353
White pine weevil, 279
Zygobothria nidicola, 316

PLATE V.

a. Infestation on place of C. D. Mexcur, Bloomfield, north of village, April 6, 1922.

b. Infestation in Bloomfield, east of village, April 6, 1922.

GIPSY MOTH WORK

PLATE VI.

a. Infestation in birches in Berlin, just east of Shuttle Meadow Country Club, April 20, 1922.

b. Infestation on white oak, Berlin, southwest of Shuttle Meadow Country Club, April 20, 1922.

GIPSY MOTH WORK

a. First infestation found in Glastonbury: on apple trees northeast of village, March 17, 1922.

b. Infestation on large apple tree in open field, Berlin: east of state road to Meriden, April 20, 1922.

a. Infestation in apple orchard, Wolcott, northeast of village, April, 20, 1922.

b. The only infestation found in Southington was on this apple tree in a yard adjacent to the town farm, April 20, 1922.

PLATE IX.

a. View in orchard of Smith T. Bradley, North Branford, showing untreated trees partially defoliated by mites

b. View in same orchard showing trees which were sprayed with linseed oil emulsion.

EUROPEAN RED MITE

a. Small spruce tree in pot showing method of confining mites for study.

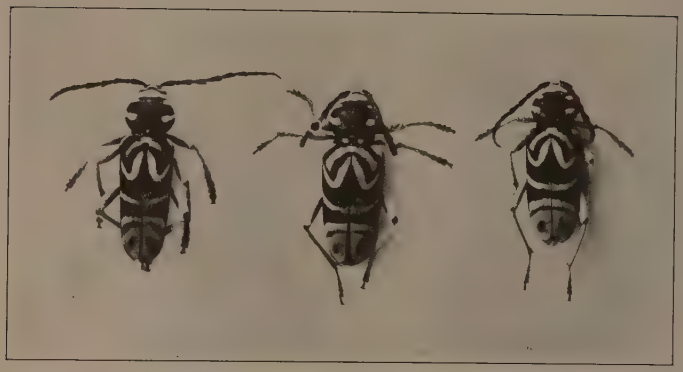
b. Web formed by mites on spruce twigs.

SPRUCE MITE

a. Left, scar on young maple tree; right, view of same tree four years later.

b. Three young maple trees in New Haven, showing scars caused by maple borer.

MAPLE BORER



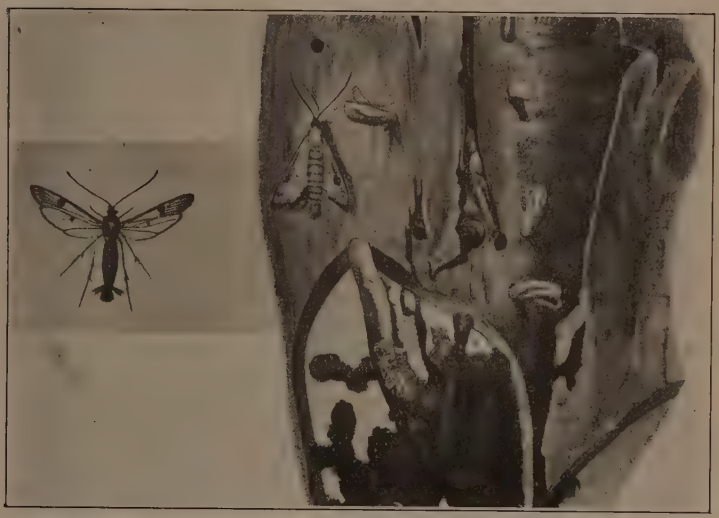
a. Adult maple borers, natural size

b. Tree partly girdled at base by maple borer.

MAPLE BORER

PLATE XIII.

a. Small exit holes of adults on injured silver maple.



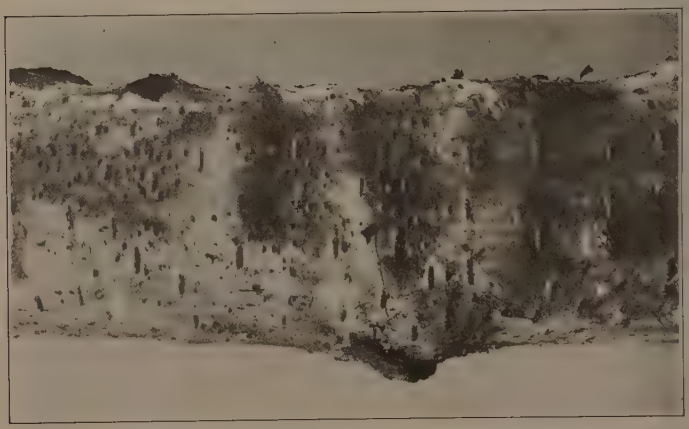
b. Adult and work of maple sesian. (After Felt).

MAPLE SESIAN

a. Curious hornworms, *Dilophonota ello* Linn. Natural size.

b. Asiatic beetle, twice enlarged.

c. Bronze birch borer, twice enlarged.



d. Ridges on birch, caused by bronze birch borer.

HORN WORMS, ASIATIC BEETLE AND BRONZE BIRCH BORER

PLATE XV.

a. Larvae, four times enlarged.

b. Adult, twice enlarged.

c. Appearance of infested stems showing adult. Natural size.

RHODODENDRON BORER

a. *Noctua c-nigrum* Linn. adult, twice natural size.

b. Larva, feeding on strawberry, natural size.

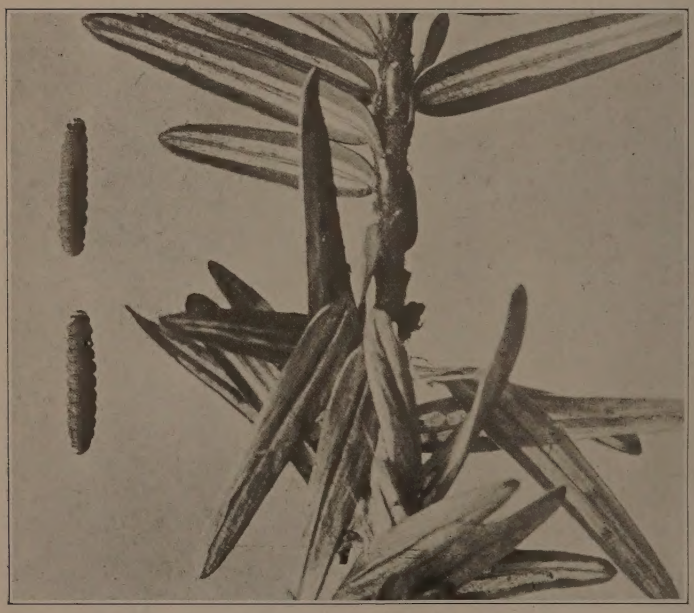
CUTWORMS INJURING STRAWBERRIES

a. *Feltia venerabilis* Walker, adult, twice natural size.

b. Pansy blossom and leaves eaten by larvae, natural size.

NOCTUID LARVAE INJURING PANSIES

a. Appearance of infested twigs, natural size.

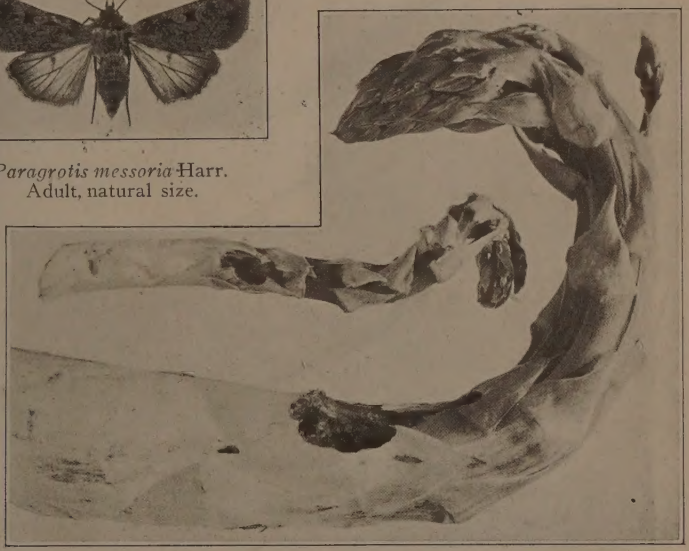


b. Webbed leaves and larvae, four times enlarged.

HEMLOCK WEB WORM

a. Raspberry shoot eaten by larvae, natural size.

b. *Paragrotis messoria* Harr.
Adult, natural size.



c. Asparagus shoots eaten by larvae, natural size.

CUTWORMS INJURING RASPBERRY AND ASPARAGUS.

a. Galls of *Chermes abietis* Linn., on Norway spruce, natural size.

b. Galls of *Chermes cooleyi* Gillette, on blue spruce, natural size.

SPRUCE GALL APHIDS